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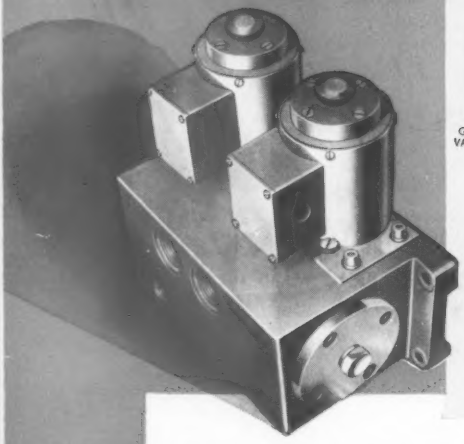

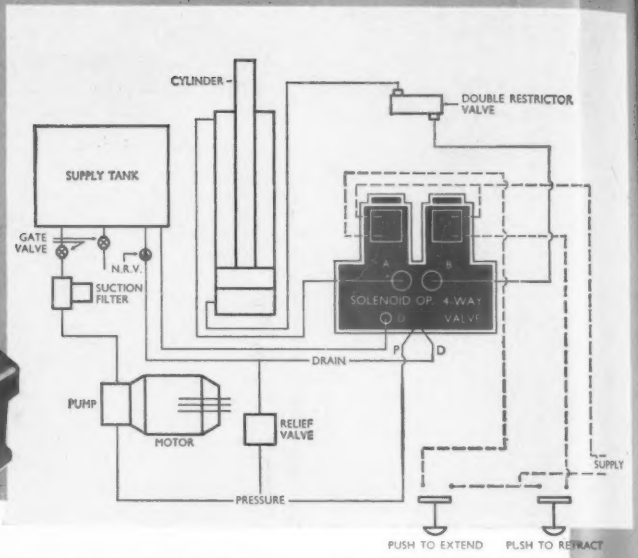

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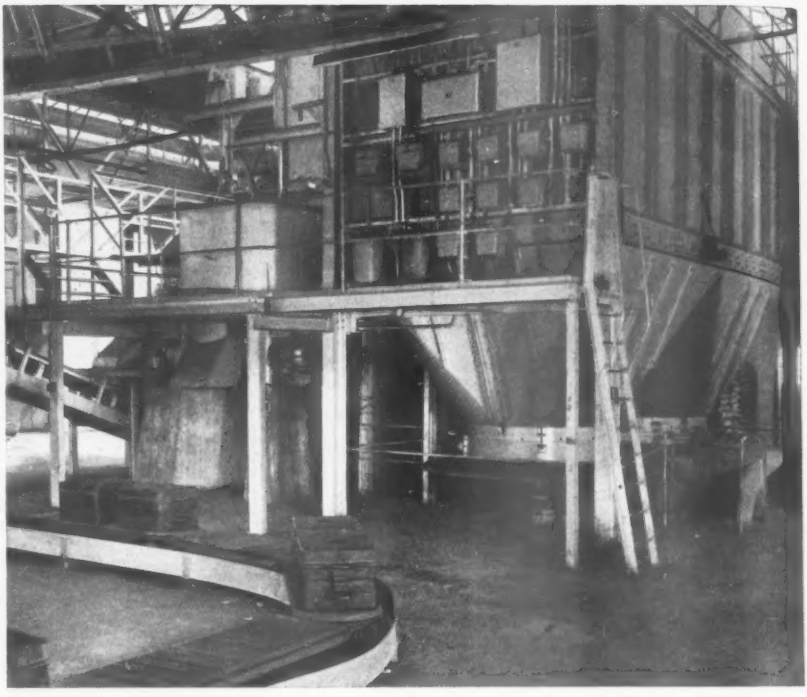
SAND PREPARATION PLANT



Photograph published by courtesy of Messrs. Shotton Bros. Ltd. Malleable Ironfoundry

Photograph shows: Two large storage hoppers with rotary table feeders, supplying reconditioned sand to belt conveyor; to bucket loader (with bifurcated chute) which charges two 2F size August-Simpson Mix-Mullers. Batch capacity of each Mix-Muller is 2,000 lb. Note the August Mould Conveyor in foreground.

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The "Outer Seven"

We do not believe that either the foundry or its equipment industries will be notably and directly affected if the economic treaty covering Scandinavia, Switzerland, Portugal and this country, comes into being. Each year there will be a small but progressive lowering of imports, until at the end of ten years, a free-trade area will come into being. The main objective is probably a gambit for the game of international trade politics, as it provides a strong bargaining point for the eventual creation of total European free trade. The implementation of the arrangement will affect, in various degrees, the fortunes of the founders' customers, and so will have an impact on the output of castings, but it will take time.

From time to time, the UK foundry industry does sell castings to some of these countries. Malleable-iron automobile castings are being sent to Sweden, whilst conversely some of these are being imported from France into the UK. Historically speaking, raw castings have been received into this country from Switzerland, Belgium, Czechoslovakia, and even the USA. Indeed, before the 1914 war, malleable-iron fittings were quite an important item on the list of British imports, but they were "killed" by the creation of several large specialized foundries in Bedford, Ipswich and elsewhere.

UK foundry equipment and supplies concerns do reasonably well in the countries of the outer seven, especially in Scandinavia, but unfortunately for several of the more important firms, trade agreements with their American associates only accord manufacturing and sales rights for the UK and the Commonwealth. Thus one sees items of equipment of designs conventional in this country being supplied from European sources. The main competitors with this country for many types of foundry plant are Germany and the USA, and much equipment from these sources was supplied between the two wars; of purchases since then, British plant has commanded a reasonable proportion. The advent of the European Coal and Steel Community had a rapid and not too happy effect on Belgium due to that country's high labour costs, but we do not anticipate any great and immediate effect in the trading conditions of the signatories of the new "outer seven" agreement.

International Foundry Congress

Papers to be presented in Spain, October 4 to 10

At the International Foundry Congress to be held this year in Madrid, from October 4 to 10, the following papers are to be presented:—

"Porosity in Steel Castings," by O. Heide.

"Influence of Free and Combined Magnesium on the Structure of Nodular Graphite in Cast Iron," by E. Ross and E. Scheil.

"Centrifugal Casting of Iron Pipes with Lamellar and Nodular Graphite" by H. A. Nipper.

"Casting and Crystallization Problems in the Manufacture of Steel Castings," by B. Matuschka.

"Analysis of Belgian Research Results on the Correlation of Mass and Physical Properties of Grey Irons," by A. de Sy and J. Van Eeghem.

"Graphitization of Nodular-graphite Cast Iron by Annealing," by P. Rys.

"Vacuum Degassing of Grey Iron" by O. Necas and R. Kamensky.

"Mechanism of the Shotblasting Process for Steel Castings," by J. Pribyl and O. Starosta.

"Penetration of Low-melting-point Metals into Foundry Sand," by K. Fursund.

"Angles of Contact in 'Green' Moulding Sands and their Relation to the Technological Properties and the Hydration of the Clays," by J. Navarro-Alcacer.

"Influencing of Feeding Heads on the Cost of Metal for Castings," by D. Escorsa Civis.

"Segregation of the Alpha/Delta Eutectoid in Cu/Sn Alloys," by F. Joanxich.

"Results of Tests on Nodular Iron inoculated with Cu/Si/Mg Alloys," by F. Rodriguez-Yúfera and J. Orland, S. J.

"Study of the Factors which improve the Modulus of Elasticity of Castings," by A. Solé Amat.

"Ferro-alloys and Inoculants for the Production of High-strength Grey Cast Iron," by H. H. Wilder.

"Technical Vocabulary and the International Foundry Dictionary," by P. Huberson.

"Influence of Size and Quality of Coke in the Operation of the Cupola," by R. Loison, L. Soubrier and M. Decrop.

"Hydrodynamic Study: Fundamentals and Practice of Feeding Systems used for Castings made in Sand Moulds"—"The Case of Multiple Runners," by M. Jeancolas, G. Cohen de Lara and H. Hanf.

"Refining Irons with Oxygen and Powdered Lime—Result of Researches carried out by the *Institute de Recherches de la Siderurgie*," by B. Trentini, P. Vayssiere, J. Francais and M. Allard.

"Behaviour of Moulding Material during Sudden Heating," by H. G. Levelink.

"Structural Changes of Aluminium/Magnesium Casting Alloys during Ageing," by L. G. J. van Ewijk.

"Manufacture of High-duty Iron," by N. G. Chakrabarti.

"Origin and Significance of Grain Structure in Sand Castings," by V. Kondic.

"Observations on Internal Tearing in Steel Castings," by I. Minkoff, C. W. Briggs and H. F. Taylor.

"Gases in Iron: Tests on Vacuum Degassing," by S. Gallo.

"Technical and Economic Study on the Contribution of Low-frequency Electric Induction Furnaces to the Modernization of Foundries," by A. Tagliaferri.

"Production of Sound Castings in Tin Bronze," by Matasaka Sugiyama.

"Manufacture of Blast-furnace Pig-iron for Nodular-graphite Cast Iron and the Resultant Properties of the Castings," by Isao Aoki.

"X-ray Film, using an Image Intensifier, of the Flow of Metals in Shell Moulds," by K. Shobayashi and K. Okamoto.

"Oxidation of Niobium," by T. Hurlen, H. Kjöllesdal, J. Markali and N. Norman.

"Researches on High-strength Zinc Alloys" by A. Krupkowski and W. Kajoch.

"Statistical Researches on the Influence of Foundry Processes on the Strength Properties of Separately-cast Test-pieces from Copper Alloys," by Z. Górny and A. Fijal.

"Study of Hot-tearing in Steel Castings," by K. Beckius, M. C. Flemings and H. F. Taylor.

Details of the programme for the Congress events were published in the April 2 issue of the FOUNDRY TRADE JOURNAL.

British Standards Institution

The British Standards Institution announces in its latest *Information Sheet* that new work is being started on austenitic steel pipes and tubes for pressure purposes; cast-iron gate valves for general purposes; components of heavy armoured conveyors used in mines; sanitary pipework and appliances (revisions of CP304 and CP305), and care and maintenance of floor surfaces. Amendment slips recently issued are for BS1121, Part 33:1955, Iron in ores, slags and refractories. Amendment No. 3, PD3435; and 1121 Part 35:1955, Aluminium in iron, steel ferro-alloys. Amendment No. 1, PD3436. Amongst the draft standards circulated for comment are CZ8551, Aircraft material 45-55-ton chromium corrosion-resistant steel (free machining, to replace D.T.D.525); CZ8589, Methods for the analysis of copper alloys, Part 6, tin (nickel coil reduction method); CZ8590, Methods for the analysis of copper alloys, Part 7, silicone (photometric method); and CZ8740, Methods for analysis and testing of coal and coke, Part 10, arsenic in coal and coke; Reprints now available include 2S100:1949, Inspection and testing procedure for aircraft steels (5s.) and S109:1949, Chromium/nickel heat-resisting steel (2s. 6d.); (both of these reprints have had amendments incorporated in the text of the standard).

Copies of these standards are from the sales branch of the Institution, 2, Park Street, London, W.1. When ordering amendment slips the PD reference should be quoted and not the BS number; draft standards can be obtained by subscribing members free of charge and to non-members the price of those listed above is 3s. 6d. per copy.

ISCOR (South African Iron & Steel Industrial Corporation) has won export contracts worth more than £7,000,000 in the past nine months. The most recent contract—valued at £1,000,000 from Japan—is for the supply of a large quantity of pig-iron to be delivered before the end of the year. Other countries to which exports are being made include the United States, Germany, Japan, the Argentine and the Philippines. Iscor's total export orders for pig-iron taken during the last nine months exceed 300,000 tons, and more than £4,000,000 in value. Orders for rolled-steel products, valued at more than £3,000,000, include a large order (worth about £750,000) for heavy rails from the Rhodesia Railways. Iscor recently installed a blast furnace—the sixth and largest at the works—at a cost of £3,500,000. This can produce 10,000 tons per week.

BCIRA Work in Progress

Comprehensive Programme of Pure and Applied Research for Iron Founders

A tour of inspection was recently made of the laboratories of the British Cast Iron Research Association at its headquarters, Bordesley Hall, Alvechurch, near Birmingham. Work in progress was explained by the staff, who demonstrated some of the special apparatus in use. Some of the more important work is reviewed below.

Shrinkage and Porosity

Soundness of iron castings is a subject of importance to every founder. Work which is relevant to the manufacture of all grey-iron castings and to some white-iron castings is being carried out at the British Cast Iron Research Association by a team which reports to the Engineering Castings Sub-Committee and the Light Castings Sub-Committee. An investigation originating from the problem of sinking under bosses, on light castings, is producing practical information of general application in light-castings foundries, and a new shrinkage-test casting has become well established in this work. The influence of the mould upon shrinkage has been shown to be related to that of pouring temperature, and investigations on these two variables are continuing.

Degree of Nucleation

Following the Association's findings on the important influence of eutectic cell number on shrinkage, it has been demonstrated that variations in the degree of nucleation of the iron may occur from time to time in the foundry, and represent variations in the condition of the metal which may give rise to shrinkage defects. As a result, the investigators have been asked to study these factors in several foundries. Research is in hand to establish practical means for controlling the degree of nucleation of the iron, and particular attention is being given to methods of decreasing the degree of nucleation. These methods involve agitation of the melt, the addition of titanium, and other variables. The Association is receiving active and valuable co-operation from a number of foundries and emphasis is being laid on the practical application of the latest control techniques in the foundry.

Solidification of 2-in. dia. Bar Castings

Of more fundamental importance, the solidification process in 2-in. dia. bar castings is being successfully investigated by means of the quenching technique, and work in hand covers the investigation of the influence of pouring temperature upon the solidification sequences of various types of cast-iron. This work provides general background data.

Mould Rigidity

A study of the soundness of large castings is being carried out in a member's foundry as part of an investigation of alloy-iron castings, and it is hoped that the Association will obtain facilities for investigation of large engineering castings in other members' foundries. In this work the mould has been found to play a leading part in governing soundness, and the value of increased mould rigidity is being demonstrated. Following work on the effect of carbon content on the soundness of test castings it is believed that, if the mould is made sufficiently resistant to casting expansion, the increased expansion associated with an increase in eutectic graphite can be used to improve soundness instead of to expand the casting. Critical studies of the soundness of K-bar test castings have indicated that castings of complicated shape show uneven distribution of casting expansion due to the presence of a hot spot. This subject is of importance in rationalizing the influence of design factors in commercial castings.

White and Chilled Cast-irons

Work on white and chilled irons is reported regularly to the White and Chilled Iron Castings Sub-Committee of the Association. It has been shown that the chilling tendency of cast-irons is influenced to an important extent by the degree of nucleation of the grey-iron eutectic, and work is in hand to study the resultant chilling tendency when the degree of nucleation is modified by varying the composition and by physical methods such as violent agitation or inoculation. The influence of chromium in promoting chilling is being studied, and it has been shown that at least some of the effect of this element may be attributed to a decrease which it causes in the degree of nucleation. White irons may have either a ledeburitic or, less usually, a platelike eutectic structure. This alloy structure may have important properties, and experiments are in hand to find ways of producing it at will. Superheating and the control of sulphur and manganese are among the methods under examination. The ways in which the eutectic structures solidify are being investigated, and improved techniques for thermal analysis and quenching from small samples are being developed.

Grain Refinement of High-chromium Irons

Preliminary experiments have shown that coarse as-cast grain-size in high-chromium irons may be avoided by melting and pouring at low temperatures, and that grain refinement can be brought about by the addition of titanium or nitrogen. Further work is envisaged to assess the relative amounts of titanium or nitrogen necessary to bring

Measuring metal temperature at the spout, in a BCIRA member's foundry.

about grain refinement at various melting and pouring temperatures. It is also proposed to investigate the influence of section size on the as-cast grain-size.

Foundry Sands

The Sands and Refractories Sub-Committee receives regular reports on the progress of foundry sand research. CO_2-process sands are being studied in some detail. Moulds made by this process produce castings of improved soundness. However, metal penetration is a problem experienced by some foundries, and a programme of work is being devised to cover a full investigation of this defect both at the Association and in members' foundries.

Shell Moulds

The room-temperature properties of shell moulds have been studied at the Association, and some future work concerns the preparation and heating of test-pieces to investigate the high-temperature properties of shell-moulding materials. The Association's original high-frequency heater proved to be inadequate for this work, and new equipment has been developed which is believed to be more advanced than any other of its kind in the world.

In conjunction with the study of the soundness of iron castings, there is an extensive study being undertaken of the properties of green-sand and other moulds. Although cement and CO_2-process moulds give castings of improved soundness, it is believed that there is a great demand for improvement in the soundness of castings made in green-sand moulds. The investigation covers the effects of additions to green-sand, and the use of high-pressure techniques to improve what has been termed the "rigidity" of such moulds.

Cast-iron for Steam Engineering

The present limiting temperature of 450 deg. F. (232 deg. C.) for cast-iron in many steam applications is considered to be too low, and a temperature of 650 deg. F. (343 deg. C.) is thought to be more realistic. A large programme of work on growth has been completed, and further work on creep is in progress to obtain data which it is hoped will lead to an increase in the limiting temperature for cast-iron for steam applications. This programme of work includes:

(*a*) Growth tests in air at temperatures up to 500 deg. C. for times up to 64 weeks.

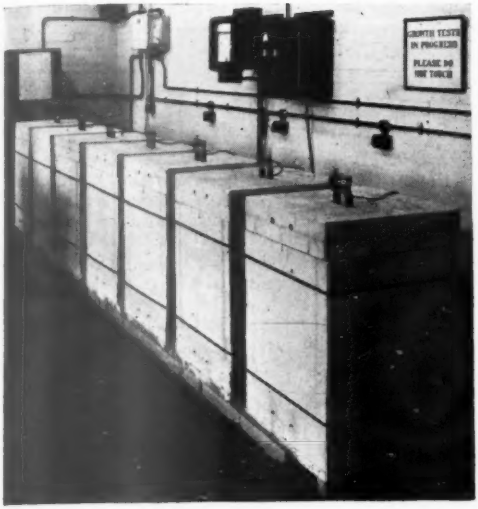
(*b*) Growth tests in steam at temperatures up to 427 deg. C. for times up to 49 weeks.

(*c*) Short-time high-temperature tensile and impact properties up to a temperature of 600 deg. C.

(*d*) Creep tests.

In the growth tests already completed it has been shown that cast-iron is not subject to growth at temperatures of 400 deg. C. and below in air or steam atmospheres. The results are considered very satisfactory and indicate that, as far as growth is concerned, the limiting temperature for cast-iron could safely be raised to 343deg. C. and still allow an ample margin of safety, since growth does not occur at temperatures of 400 deg. C. and below. Long-term growth tests

Member of the BCIRA staff counting eutectic cells.



Battery of furnaces, at Bordesley Hall, for growth testing at low temperatures.

are in progress at 400 and 350 deg. C. in air, to see if exposure for many years causes any deterioration in properties that is not detected in the tests of 64 weeks' duration.

Creep Data are needed

While the growth tests are considered satisfactory, the present limiting temperature for cast-iron will not be raised in this country unless creep data are also available. To supply these data six 5-ton Denison T.45 creep machines have been installed, and tests have been in progress for some time. These tests are being carried out on an unalloyed flake-graphite cast-iron at temperatures of 400 and 350 deg. C. This material has already shown satisfactory growth resistance, and if it is also found to have satisfactory creep properties it may render unnecessary a great deal of work in testing cast-irons, which might be assumed to have superior creep properties to the unalloyed iron. The creep tests are carried out on a 5,000-hr. basis, and stress *versus* log time curves are being obtained at the two temperatures to give the designer the data required.

Mechanical Properties

A programme of work is under way to correlate eutectic cell size with mechanical properties, and also to test relationships between the various properties established by other workers. The effect of phosphorus on tensile strength, Brinell hardness, modulus of elasticity and stress/strain properties has been investigated in detail.

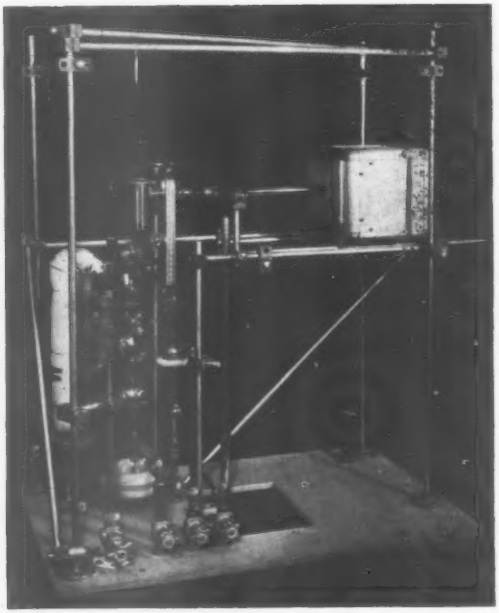
Stress-strain Curve for Cast-iron

The stress/strain curve for cast-iron in tension and compression is undergoing comprehensive examination. This work has already indicated that in tension the graphite present might be considered as a void in the matrix, and under stress the shape of the void is changed, resulting in an increase in volume of the cast-iron as a whole. The strain which occurs under tensile stress is due to elastic and plastic deformation of the matrix, and also to the enlargement of voids created by graphite flakes. The recoverable strain characteristics of cast-iron depend on the extent to which the voids, created under stress, recover on unloading. Fatigue tests carried out on a routine basis will provide additional data on cast-iron.

Malleable Iron

Reports on matters relating to malleable iron are reviewed by the Malleable Castings Sub-Committee. Present work includes the determination of means of obtaining optimum mechanical properties in blackheart malleable iron. The influence of silicon content and of phosphorus content on the tensile, bend and unnotched impact properties has been assessed on laboratory materials which were annealed commercially. These tests have been extended to obtain similar data on representative materials which have been annealed in inert atmospheres to eliminate effects due to surface carbides, decarburized ferritic rim, and pearlitic rim. The influence of silicon, carbon and phosphorus contents are studied. The mechanical properties of normalized and spheroidized pearlitic malleable iron are being assessed, and also the effect of quenching and tempering treatments on the tensile and impact properties of these materials. With the aim of improving the tensile properties and annealability of ordinary blackheart malleable iron,

Hexhlet dust-sampling apparatus in use in the BCIRA experimental foundry. In this case the Hexhlet is driven by a portable vacuum pump.



BCIRA apparatus for the determination of hydrogen content in cast iron by vacuum-heating.

experiments are in hand to show that bismuth/boron additions may be successfully used to obtain as-cast material, of relatively high silicon content, which is completely white in fairly heavy sections. Continuing work is concerned with determining whether these materials anneal satisfactorily, particularly in thick sections.

Specification for Pearlitic Malleable

A British Standard Specification for the properties of pearlitic malleable iron is under consideration. Although tests already carried out give extensive information, and are more or less complete in themselves, it is envisaged that more co-operative work of a similar nature between the Association and the malleable industry will be required, before an agreement is reached between producer and consumer on the precise requirements of the final specification.

Ingot-moulds and Bottom-plates

The Association continues to co-operate with the British Iron and Steel Research Association in its studies of ingot-moulds and bottom-plates, and current work includes a study of the structures of ingot-moulds to determine the variations of structure within a single mould, or from mould to mould of a number of moulds. The Association provides a considerable amount of assistance to ingot-mould foundries in their day-to-day problems. Work for one group of foundries, and for the steel company to which they supply ingot-moulds and bottom-plates, covers a wide investigation of the soundness, lives, premature failures, and metallurgy of these castings.

Gases in Cast-iron

A great deal of work has been carried out on the causes and cure of pinhole defects in cast iron, It has been shown that these are seriously promoted by the introduction of aluminium into the iron. In recent months the occurrence of pinholing, arising from the use of aluminium in high-manganese pearlitic malleable iron, has been dealt with in a number of foundries. The use of boron as a substitute for aluminium in this material is under test, and alternative additions are being sought. The work includes the effects of other trace elements in ferro-silicon upon pinholing, and extensive study is being made of specially prepared pure addition alloys with controlled minor-element contents. This programme of work utilizes the Association's vacuum melting and casting furnace, using both vacuum and protective atmospheres. The effects of ferro-silicon and other addition alloys containing various trace elements upon chill removal, mechanical properties and eutectic cell number are to be investigated in detail.

Hydrogen Treatment of White Iron

It has been demonstrated that the hydrogen treatment of white iron of malleable composition prior to casting reduces the time of subsequent annealing, provided that the residual hydrogen content is low. This investigation is to be extended to cover a wide range of hydrogen contents both before and after casting, and attention will also be paid to a range of sulphur contents to determine the interaction between hydrogen and sulphur under these conditions. The effects of prior heat-treatment on subsequent annealing rate are being investigated, with special reference to the effects of hydrogen during prior heat-treatment.

Chemical Analysis

The first part of a handbook giving methods recommended by the Association's Methods of Analysis Sub-Committee has now been published. Part 1 refers to cast iron and pig-iron, and subsequent parts will deal with the analysis of alloy irons, ferro-alloys and slags. This year, methods for austenitic and acicular irons, nodular graphite irons, Vantit pig-iron, ferro-chromium, ferro-molybdenum, mischmetall and nickel/magnesium alloys are being examined in collaboration with the Sub-Committee. The Sub-Committee is also examining a rapid method for magnesium published by the analytical section and this will be submitted to the British Standards Institution as a standard method.

Trace Elements

The metallurgical significance of trace elements has become of increasing interest recently, and this has led to the development of methods capable of determining amounts of elements from 0.001 to 0.00001 per cent., or even lower. These methods usually employ instrumental techniques such as polarography, absorption spectrophotometry or

flame-photometry. A previous chemical separation is generally employed and this is frequently based on solvent extraction, although ion exchange and co-precipitation are sometimes used. At present the investigator is examining methods for boron and cerium. The determination of trace elements calls for a high degree of skill on the part of the analyst, high-quality reagents, spotlessly-clean apparatus and careful attention to detail. In some cases the lower limit of the method is determined more by the purity of available reagents than the sensitivity of measuring apparatus. A committee to investigate ways and means of obtaining purer reagents has been formed and the Association is represented on this.

Cupola Slag

During the past few years, the analysis of cupola slag has been revolutionized by the employment of solvent extraction, spectrophotometry and complexometric titration. A complete analysis now takes only four to five hours. Ultra-rapid methods for silica and lime are now under consideration. A sensitive recording flame-photometer built at Alvechurch may be applied to slag analysis.

Spectrographic Research

The Spectrographic Department, which deals with the routine analysis of some 19 elements in iron, also carries out research work on the extension of spectrographic techniques to other elements and materials. An important project is the spectographic analysis of slags. A solution method has been established which will give the analysis of six slag components in 45 minutes. A series of standard slags has been prepared synthetically from pure oxides and these have been used to calibrate the spectrograph. It is hoped to obtain an analytical accuracy of ± 3 per cent. of content by this technique. The Department is continually working to improve the detection and measurement of trace elements in iron and steel.

Cupola Research

Following the installation of the new cupola plant an extensive programme of research is being planned under the guidance of the Fuels and Furnaces Sub-Committee. The new plant was fully described in the FOUNDRY TRADE JOURNAL of May 28, 1959.

Corrosion of Cast-iron

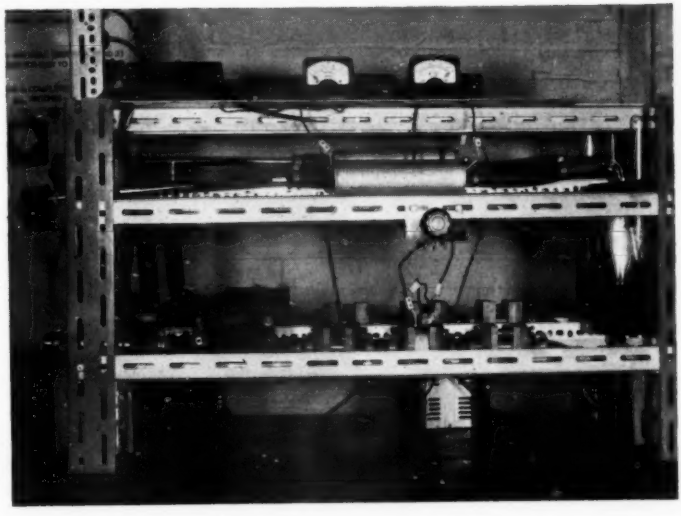
The activities of the corrosion section are concerned with three broad aspects of corrosion, two of which are involved with relatively long-term investigations, while the third is concerned with solving members' problems submitted on a day-to-day basis. In the course of this "trouble shooting" a very wide variety of problems is encountered, ranging from the corrosion of cast iron by natural waters to the corrosion of cast iron used in the manufacture of industrial alkalis, acids and salts. Many of these problems require small-scale investigations to be specially initiated. Two lines of long-term research which have been pursued in recent years are concerned with the problem of pitting of cast-iron ship-propellers, and the excessive corrosion of cast-iron road-vehicle cylinder-blocks and -heads by anti-freeze solutions.

Pitting of Ship-propellers

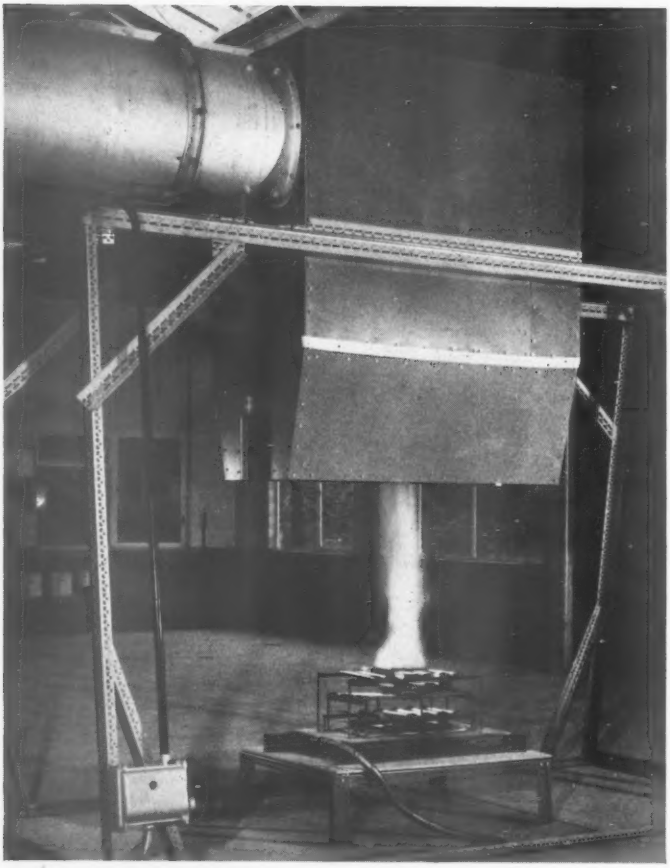
Work has shown that most of the cases of the rapid deterioration of cast-iron propellers in service could be countered by the use of magnesium anodes secured to the butt-end of the tail-shaft of the ships. In a few cases, however, this remedy has not been found effective, apparently because of the difficulty of insulating the propeller from the hull. As an alternative to cathodic protection the available propeller-coating materials are being studied. A more detailed study is also being undertaken of the mechanism of the cathodic protection process, in order to establish the degree of protection required by individual ships.

Corrosion by Antifreeze Solutions

The problem of corrosion of cast-iron cylinder-blocks and -heads in antifreeze solutions in certain heavy road vehicles has recently become serious, because of the danger of the corrosion products blocking the radiator matrices and causing overheating. The Association has carried out field tests in order to define the problem, and a rig has been constructed to simulate conditions in which antifreeze is used. It has been shown that



Range of apparatus for studying corrosion of cast iron by anti-freeze solutions.



Prototype bifurcated hood for studying up-draught ventilation of foundry knock-outs.

corrosive conditions arise because of the simultaneous depletion of the corrosion inhibitors from the solution and the oxidation of the glycol to formic acid. Work is being done to establish more clearly the mechanism of the oxidation of the glycol, and it is hoped that data will eventually become available from which a more universal inhibitor system for road-vehicle engines may be developed.

Enamelling of Cast-iron

An investigation into the effects of various types of shot-blasting grits on the occurrence of enamel boil defects has been initiated in collaboration with several member companies. Experiments have been carried out in hand-blast cabinets at various plants, using several types of grits. Visual examination of specially prepared test-plates, and also actual hollow-ware castings, has indicated that after shotblasting considerable differences in surface appearance occur from plant to plant, in spite of the fact that all are intended to be suitably cleaned for subsequent vitreous enamelling. Microscopic examination of sections cut from the test plates and castings has shown considerable differences in their surface properties.

Mechanical Grading of Grits

Mechanical grading of the grits has shown that those which produce rough and damaged surfaces have a high percentage of particles retained on the Nos. 16-, 18- and 22-mesh sieves. Those grits giving a comparatively smooth and undamaged surface contain large percentages on the Nos. 44-, 60-, 100- and 150-mesh sieves, with only very small amounts on the Nos. 18- and 22-mesh sieves. Thus it has been possible to correlate the degree of enamel boil and pinhole defects occurring using the range of grits studied. Grits containing a large percentage of fine material have been found to give less susceptibility to boil and pinhole defects than those containing a high percentage of coarse particles. These results have already been applied in an industrial plant, and a reduction in the percentage of scrap caused by boil and pinhole defects has been deported.

Slag and Dross Defects in Cast-iron

Research is being carried out on the elimination of slag and dross defects in cast-iron. These defects are difficult to classify and have entailed the development of new techniques in the identification of foreign material entrapped in castings. Much use has been made of the petrographic microscope. Results of this work have already shown the importance of ladle refractories and cupola botting materials, the latter usually being overlooked or regarded as unimportant. A low-fusion-temperature botting-clay has been shown to cause casting defects, due to entrapment of fused dross in the metal stream.

Static and Dynamic Strain Measurement

Apparatus has been acquired and a technique developed for the measurement of strain due to static, or rapidly changing stresses, by the use of electrical-resistance strain-gauges. Strains of as low as 10^{-5} (which in a normal engineering cast-iron represents a stress of approximately 140 lb. per sq. in.) can be measured, and alternating stresses at frequencies up to 200 cycles per second can be

detected and recorded. It is hoped in the near future to develop the apparatus to detect stresses alternating at much higher frequencies. The apparatus is at present being used to investigate the possibility of stress relief by vibration at room temperature.

Foundry Operations Section

This Section was, until recently, known as the Operational Research Team, and as such was instituted in June, 1950. Its function is to provide the ironfoundry industry with an advisory service on production efficiency, and general problems appertaining to productivity. The department consists of a small group of people, with a wide practical experience in the foundry industry, who specialize in production problems.

Visits to Foundries

Although problems can be dealt with by correspondence it is normally necessary to visit the foundry, and this can be done at the request of the firm concerned. The scope of the work carried out is both wide and varied, depending on the type of problem submitted. In some cases it is necessary to make a general survey of a foundry, in which case all sections are carefully examined so that a long-term plan of development for the future may be formulated. Most of the visits, however, are concerned with specific problems of diverse character, including the layout of entirely new foundries, the development of mechanized units for machine or sand-slinger moulding, cupola charging, core production, scrap control, and so on. A visit usually occupies two days, but a longer visit can be arranged if the problems justify it. A report embodying the findings is provided after the visit, and the whole service is strictly confidential. Considerable importance is attached to production flow-lines, and particular attention is therefore given to the routing of materials to and from, and also within, the foundry. The Section is vitally concerned with handling problems, and hence with the use of mechanical aids, and fully mechanized equipment. When necessary, schemes for mechanized layouts are developed, and diagrammatic sketches prepared to depict the ideas.

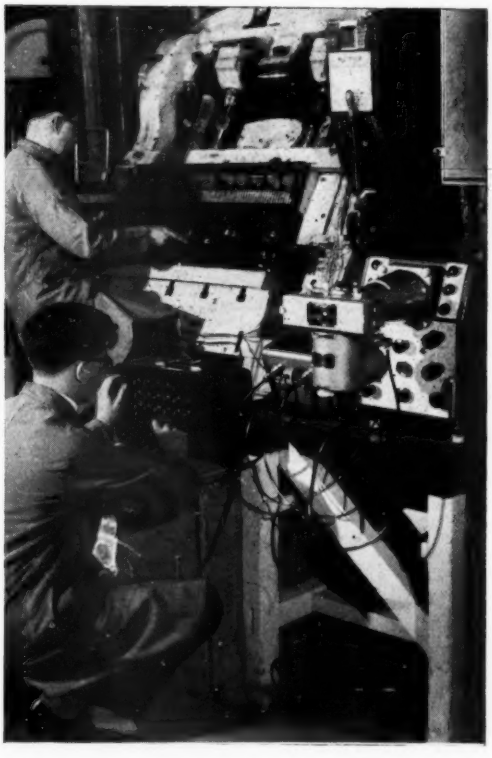
"Memo-motion"

In all its work the Section is making increasing use of methods engineering principles, particularly on specific layout problems. Considerable interest is being displayed in a form of time-lapse cinephotography known as "memo-motion." The Section has acquired the necessary equipment for this technique, and the scope of its activities has therefore greatly increased. After initial trials, it is quite evident that memo-motion has much to offer as a means of "sampling" production procedure. This technique is now available to any member-firm whose problems warrant its use. "Memo-motion" is also being used as a basis for general investigations and certain aspects of production common to many foundries are being examined, with the object of comparing and analyzing the various techniques employed.

Foundry Atmosphere Section

The Foundry Atmospheres Building has only recently been completed, at a cost of some £25,000, and was officially opened by Dr. J. G. Pearce on May 28, 1959. It provides workshop and laboratory facilities for the Association's experimental programme on foundry atmospheres, and also houses the team of investigators. In the past, the experimental work carried out by the Foundry Atmospheres Section has been largely concerned with devising methods of dust control for foundry operations which involved the formation of concentrated dust plumes. Knocking-out, grinding, wire brushing and bar de-coring are typical examples, and the work done has led to the successful introduction of new designs of equipment. The Section is equipped with dust-sampling and measuring equipment, and it is intended to carry out surveys of foundry atmospheres to determine the extent of the dust hazard, and to establish the sources of air-borne dust and methods by which it can be controlled. In addition to the above programmes, the Foundry Atmospheres Section carries out a number of *ad hoc* investigations of members' problems relating to ventilation and dust control.

BCIRA research staff studying stresses in a machine, using strain gauges.



Knock-out Equipment

Laboratory-scale investigations are now in progress on the design and performance of foundry knock-out equipment. Following earlier work on down-draught designs, particular attention is now being paid to the use and efficiency of side-draught and up-draught principles. Some attention is also being paid to the general principles and design of fettling benches, and these will be constructed and studied for a wider range of conditions than are covered by existing equipment.

"Bronze World"

The illustration shows a war memorial to the Commonwealth Air Forces which was unveiled by Her Majesty the Queen during her recent visit to Green Island, Ottawa, Canada. The memorial takes the shape of a globe "framework" executed in extruded metal, with solid cast-bronze landmasses superimposed. The globe, with vertical centre axis, stands on a bronze plinth embellished by three statuettes of beavers, again in bronze. The whole construction is surmounted by a bronze eagle which has a wing span of eight ft. This work of art was produced by the united efforts of Birmingham Guild, Limited, and McKechnie Bros., Limited, both of Birmingham.

Hungarian Non-ferrous Research

Volume II of the proceedings of the Hungarian Research Institute for Non-ferrous Metals has just been published and among the 20 communications contained in its 250 or more pages are two which concern the foundry industry. Brief synopses of these are as follow:—

Use of Pre-heated and Gas-pressured Feeding in the Casting of Non-ferrous Metals, by Gy. Emöd and L. Tóth.

The practical application of preheated and gas-pressured feeder heads. When experimenting with preheated feeder heads, it was found that the most reliable way for heating is by using a heating ring. The use of powdered heating mixtures was found unreliable, a heating cartridge put into the riser being more reliable. When experimenting with gas-pressured heads, a suitable gas-developing material was found, for casting temperatures below 700 deg. C., in the form of a mixture of sawdust and resin, or elementary sulphur. For temperatures higher than 900 deg. C., chalk powder or dolomite may be recommended. When using dried moulds, the gas-pressured head must be used simultaneously with a cooling cap. According to the economic calculation, a considerable saving may be attained by using the above methods.

Effect of Additional Elements on the Grain-size and Cracking of cast Al/Mg/Zn-type Alloys, by Z. Buray.

Investigation by the ring-casting tests of the macroscopic structure of cast Al/Mg/Zn-type alloys. In the case of the ternary alloys, it was found that increase of the Mg content results in a more drastic reduction in the grain size and the cracking tendency also, whereas increase of the Zn content has a negligible effect. When investigating the effect of further additions to the Al/Mg/Zn alloys, it was found that Fe and Si, each up to an amount of ½ per cent., exert a negligible effect on the macroscopic structure. When present in an amount of 1 per cent., however, they have a great effect on the grain refinement and the reduction of the cracking tendency. Cu up to 1 per cent. coarsens the grains and impairs the cracking resistance. Ti, in an amount of more than 0.3 per cent., and B, more than 0.1 per cent., are strong grain-refiners and reduce considerably the cracking tendency. A high Fe:Si ratio, for example (Fe+Si)=0.5 per cent., refines better than a low Fe:Si ratio. Simultaneous additions of Ti and B have a strong grain-refining effect and reduce the cracking. The temperature of casting has a greater effect on both properties investigated and the cooling rate and gas content exerts an improving effect. Although the cracking tendency of cast materials depends on several factors, there is an interesting relation between the grain-refining action and the alteration in the cracking tendency.

Copies of these papers (in Hungarian) are available on loan on application to the Editor of this JOURNAL.

ACCORDING to *Modern Castings*, the American Brake Shoe Company, of Mahwah, New Jersey, is making steel castings to give 125 ton per sq. inch in ultimate tensile strength; 104 tons per sq. in. yield point and 5.5 per cent. elongation. The castings are made for the aircraft industry and weigh 250 lb.: are 36-in. dia. and cu. of 0.125 in. section. Ceramic moulds are used for their manufacture.

American Letter

Stainless Steel Castings in Nuclear Power Plants*

The use of stainless-steel castings in high-pressure, high-temperature nuclear-power plants is increasing. This fact was confirmed by users and producers attending the recent Heat and Corrosion Resistant Alloy Castings Conference, held at the International Nickel Company's Harbor Island test station, Wrightsville Beach, N.C. The major advantages of these castings are formability of complex shapes, and high-temperature strength. Typical of the various installations described at the conference were the following:—

Shippingport Power-station Pump

In the Shippingport atomic-power station recently put in operation by the Duquesne Light Company, the Westinghouse-designed pressurized water-reactor has four primary coolant loops, each of which includes cast main stop valves and a large, complex, double-volute pump-casing. This 3½-ton pump casting is made of ACI-type CF-8 alloy (0.08 max. C; 1.50 max. Mn; 2.00 max. Si; 0.04 max. P; 0.04 max. S; 18 to 21 Cr, and 8 to 11 per cent. Ni). The 18in. valve bodies, which must have a high degree of reliability, are also cast of type-CF-8 alloy.

Volute-pumps for Reactor-plants

Huge cast-stainless volute-pumps, about double the weight of similar units in the Shippingport reactor, will be used in the Yankee Atomic Electric Company (Rowe, Mass.), and Con Edison (Indian Point, N.Y.), pressurized-water reactor-plants. Each of these type-CF-8 7-ton pump casings will have a capacity of 24,000 gall. per min. As in the Shippingport plant, flow in the primary loops of these newer installations will be controlled by cast-stainless valves.

Pump for Liquid Sodium

Detroit Edison's Enrico Fermi nuclear-power plant, now under construction at Monroe, Michigan, will include a pump cast of type-CF-4 (0.04 max. C; 1.50 max. Mn; 2.00 max. Si; 0.04 max. P; 0.04 max. S; 17 to 21 Cr, and 8 to 12 per cent. Ni) or CF-8C stainless alloy (0.08 max. C; 1.50 max. Mn; 2.00 max. Si; 0.04 max. P; 0.04 max. S; 18 to 21 Cr; 9 to 12 per cent. Ni, and Cb × C min.—1.0 max., or Cb-Ta 10 × C min.—1.35 max.), to handle liquid sodium at 800 to 1,000 deg. F. This will be the first fast-breeder-reactor central station power-plant to utilize liquid sodium as a heat-exchange medium to generate steam.

Elbow for SPERT-III Reactor

Scheduled for use in the SPERT-III reactor (Special Power Excursion Reactor Test III) is a 16-in., 90-deg. elbow made of ACI-type CF-4 cast-stainless alloy. It has a high-temperature yield-strength that is 20 per cent. higher than that required by the code for unfired pressure vessels. Many fittings cast of this alloy are used at the bottom of the SPERT-III pressure vessel, which contains two 16-in. inlet-cooling-water lines. In this heterogeneous, thermal reactor the pressurized-water coolant makes two passes through the core with a maximum flow rate of 20,000 gall. per min.

CF-8C Impellers

Reports from some equipment builders indicated a need for improved materials to handle liquid-metal coolants. Apparently under certain conditions, sodium, one of the important heat-transfer media, extracts carbon from stainless-steel. However, a technical expert from an important pump-building firm reported that his company had made, and successfully tested, pumps with impellers cast of type CF-8C (containing columbium), for handling liquid sodium around 950 deg. F. This latter company is now designing an all-cast-stainless pump (both impeller and casing) of type CF-8, to handle uranyl sulphate.

Some users expressed the desire for alloys stronger than those now used in pressurized water reactors oprating in the 600 to 1,000 deg. F. range. Several answers to this problem were suggested, including the use of high-carbon partially-ferritic alloys, such as ACI-type HE (0.20 to 0.50 C; 2.00 max. Mn; 2.00 max. Si; 0.04 max. P; 0.04 max. S; 26 to 30 Cr; 8 to 11 Ni, and Mo 0.5 per cent. max.).

All those present at the conference agreed that there was no doubt of the bright future for cast-stainless alloys in nuclear power-plant construction.

* Abstract from an article in the May issue of *Industrial Heating*.

Machinability of Grey Cast-iron*

Common types of unalloyed cupola-melted grey cast-iron were studied, to determine how changes in some of the major constituents of their microstructures affected machinability. This study made use of lineal analysis, a quantitative method of classifying microstructure. Using this method, numerical values were obtained for: (*a*) Relative volume of pearlite, (*b*) Relative volume of graphite. (*c*) Relative size of the graphite flakes. The results of the study showed that an increase in machinability rating was obtained by: (1) A decrease in the relative volume of pearlite. (2) An increase in the relative volume of graphite. (3) An increase in the relative size of the graphite flakes.

The test-bars used were unalloyed, and ranged in carbon equivalent from 3.90 to 4.50, and in tensile strength from about 8.9 to 17.8 tons per sq. in. The machinability indices for the study were obtained from constant-pressure lathe tests. These tests were based on the fact that materials of different machining qualities cut at different rates when surface speed, depth of cut, and tool geometry are held constant, while a fixed lateral force is applied to the tool.

* Synopsis of a paper, by W. W. Moore and J. O. Lord, presented at the AFS Congress in Chicago (April 13 to 17). W. W. Moore is principal metallurgist, Process Metallurgy Division, Battelle Memorial Institute, Columbus, Ohio. J. O. Lord is Professor of Metallurgy, Department of Metallurgical Engineering, The Ohio State University Columbus, Ohio.

More Machine-tool Orders

Orders for machine tools in America continued to improve for the fourth consecutive month, according to figures published by the National Machine Tool Builders' Association (see Table 1). The net total of new orders was nearly twice as great as a year ago, but still substantially short of the 1957 level.

TABLE 1.—*Net New Orders for Machine Tools.*

(Thousands of dollars.)

	1957.	1958.	1959.
	$	$	$
January	75,500	26,850	41,050
February	71,900	28,300	45,500
March	72,750	36,150	51,550
April..	64,300	28,300	53,450

Company News

MORGAN CRUCIBLE COMPANY, LIMITED—There is to be a scrip issue capitalizing £1,762,268 of reserves on the basis of two-for-five in £1 "A" for the "A" holders and in £1 "B" for the "B" holders.

THOS. FIRTH & JOHN BROWN, LIMITED, steelmakers, of Sheffield—A one-for-four scrip issue is announced. The directors intend to maintain the final dividend at 6 per cent. on the capital as increased by the scrip issue.

CRAVEN BROS. (MANCHESTER), LIMITED, machine-tool makers, etc., of Reddish—Suggestions by the chairman of another company were made for some form of association, possibly involving a merger, but it was decided that there could be no useful form of association.

TRIPLEX FOUNDRY, LIMITED—Issued share capital of R. A. Roobottom, Limited, Walsall Sheet Metal Company, Limited, and Vernier Tool & Gauge Company, Limited, all Walsall companies specializing in press-work and sheet-metal fabrication, has been acquired for a total consideration of £28,000.

ENGLISH ELECTRIC COMPANY, LIMITED—Interim of 3 per cent. is being paid for 1959 on capital increased by one-for-10 rights and one-for-two scrip issues. The previous year's interim, allowing for the capitalization, was equivalent to 2¾ per cent. on the present capital and the total payment equivalent to 9¼ per cent. It is stated that the rate of the present interim carries no implications as to the total payment.

WOODALL-DUCKHAM, LIMITED, contractors for gas-works, carbonizing plants, coke ovens, etc., of London, S.W.3—The company has acquired the whole of the share capital of Nordac, Limited, manufacturers of chemical plant, of Uxbridge (Middx), by the issue to Nordac shareholders of 185,189 ordinary shares of 5s. each in Woodall-Duckham. Nordac will continue to operate as a separate company within the Woodall-Duckham group.

DOWTY GROUP, LIMITED—The chairman, Sir George Dowty, says that a reduced demand has been experienced from the National Coal Board and sales of mining equipment are now only one-third of what they were 18 months ago. He adds: "If coal is to compete with oil and other fuels, production and distribution costs must be reduced. The irony of the situation is that our mining equipment can reduce the cost of coal-getting considerably."

H. & J. HILL (WILLENHALL), LIMITED ironfounders, etc.—In deciding to reduce the interim dividend from 7½ per cent. to the 5 per cent. on account of 1959, the directors state that they have taken into consideration the recession which took place in the industry early this year and which automatically affected the company's profits. The present position shows a considerable improvement which, it is hoped, will continue, it is added. A total dividend of 25 per cent. was paid for 1958.

HOLMAN BROS., LIMITED, founders, mining, and pneumatic plant specialists, of Camborne—Firm orders received during the first six months of this year showed an increase of about 25 per cent. on the first half of the previous year. Anticipating that profits will benefit, the company is maintaining the dividend at 12 per cent. for 1958-59. A fall in home sales is largely attributed to a reduction in sales to the National Coal Board. Group profits, before tax, were £218,385 (£461,633) and the net profit amounted to £119,386 (£221,429).

Law Cases

Judgment "With Regret"

Giving judgment for the defendants, the Brightside Foundry & Engineering Company, Limited, Judge Ernest Ould, at Sheffield County Court on Thursday, August 13, said he did so "with regret." He had heard a claim for damages brought by Mr. Jack Hunter, who said that he had fallen and broken his ankle when returning to his machine. His left foot touched one of a pile of bars and caused him to stumble towards holes in the factory floor.

A witness alleged that the holes in the floor, which had been there for four or five years, were filled in between a week and a fortnight after the accident. Judge Ould said his difficulty had been to decide whether there was sufficient proof that the holes had anything to do with the accident.

Women Working Machines

Where women worked machines which were potentially dangerous, it was the employers' duty to see that someone was at their elbow when their work was altered from one machine to another, said Mr. Justice Paull, giving judgment at Sheffield Assizes on June 29 in an action brought by Mrs. Olive Fielding (33) against British Ropes, Limited, Doncaster. The plaintiff was awarded £2,000 and costs for injuries received when working a wire-stranding machine at the company's Retford factory.

It was stated that Mrs. Fielding was told to work a machine she had never operated before. She assumed it was similar to the one she had left, but it was operated by press buttons instead of a handle, and started immediately. On behalf of the company it was stated that the plaintiff had had instructions in the use of the machine 18 months earlier.

The judge said that because of the accident Mrs. Fielding was now virtually one-handed. He was not prepared to find that she was so deliberately negligent that her damages should be diminished.

North British Locomotive Changes

Retirement of Mr. T. A. Crowe, chairman and chief managing director, from the board of the North British Locomotive Company, Limited, Glasgow, brings two recently appointed board members to the head of the company. Mr. Thomas Coughtrie is the new chairman and Lord Reith is appointed vice-chairman.

Mr. Coughtrie, who joined the board some months ago, founded and is a director of the Belmos Company, Limited, colliery and industrial switchgear manufacturers, of Bellshill (Lanarkshire). He was only 23 when he founded the company in 1919; it has since grown and now has branches in Dundee and London. Lord Reith, whose appointment as a director was only announced last week, is also a director of Tube Investments, Limited, Chesterfield Tube Company, Limited, the British Oxygen Company, Limited, and a number of other companies.

Increases in Capital

RAPID MAGNETIC MACHINES, LIMITED, Birmingham, increased by £80,000, in £1 shares, beyond the registered capital of £50,000.

HEAT TREATMENT & BRAZING COMPANY, LIMITED, London, S.W.1, increased by £10,000, in £1 ordinary shares, beyond the registered capital of £10,000.

JESSOP-SAVILLE, LIMITED, steelmakers, ironfounders, etc., of Sheffield, increased by £1,158,000, in £5 shares, beyond the registered capital of £600,000.

Temperature-control Methods in the Heat-treatment of Aluminium Alloys

By G. Fitzgerald-Lee, F.R.Econ.S., M.I.E.I., A.R.Ae.S.

The best plant in the world is useless without accurate temperature control, which is fundamental to heat-treatment processes. As it is so important, it is helpful if the underlying principles are known to the works' personnel connected with heat-treatment. Although the following article is written particularly for founders engaged in treating aluminium alloys, many of the remarks are, of course, equally applicable to the processing of other cast metals.

Pyrometric equipment supplied by reputable makers is robust and reliable; periodic maintenance by a service engineer is normally provided, and expert advice is available from the manufacturers. But all this should be thought of as being supplementary to the regular maintenance carried out by the work's technical staff responsible for the heat-treatment operations.

THERMO-ELECTRIC COUPLE

Although liquid- or vapour-pressure thermometers may be employed at the low temperatures required for precipitation treatment or stress relief, the pyrometer most commonly used for light-alloy heat-treatment is the thermo-electric couple. This is simpler than the electric resistance pyrometer which is occasionally employed. Pyrometers may be used as indicators only, as recorders or controllers, or as combinations of these. In oil or salt baths temperatures are often controlled by bimetal thermostats. But no matter which type of instrument is used, the hot end must be so placed as to measure the temperature of the metal rather than a zone of the furnace. Where, as in standardized heating, the pyrometer is situated comparatively remote from the work under treatment, accurate calibration of the instrument with regard to a particular furnace and operation is essential. Special positions are used in many forced-air-circulation furnaces.

Principle of Operation

When wires of two dissimilar metals are joined at one end and connected to a sensitive millivoltmeter at the other, any difference in temperature between the two ends of the wires results in a small electromotive force, which causes a deflection of the measuring instrument. The magnitude of the e.m.f. generated depends on the difference in temperature between the two ends of the wires, and the indicators are usually calibrated to read temperatures direct. The two wires constitute the thermocouple. The ends which are heated (the hot junction) are joined by welding, while the opposite ends of the wires (the cold junction) are located outside the furnace.

Cold-junction Temperature

Since the current produced is proportional to the temperature difference between the hot and cold junctions, any variation in the latter must be allowed for. Either the cold junction should be kept at a constant temperature, or a suitable compensating device used. A constant cold-junction temperature can be obtained by bringing the ends of the wire into a vacuum flask filled with ice, oil, etc., or to water-covered heads, or by burying them in an airtight container at least three feet in the earth. The zero of the instrument is then adjusted to correspond to the cold-junction temperature.

Compensating Leads

However, it is usually more convenient to locate the cold junction at the measuring instrument by employing "compensating leads" between the actual thermocouple wires and the instrument terminals, the leads being of metal of the same thermo-electric properties as the couple. The instrument is fitted with an automatic cold-junction compensator, consisting of a thermostatic spiral connected to the control spring of the millivoltmeter. The cold-junction reading needs to be checked at only fairly long intervals. The following points are important: the compensating leads must be connected to the correct terminals at the couple head and at the instrument, otherwise inaccurate readings are obtained; all leads from the thermocouple to the cold junction or instrument must run in conduits to reduce deterioration of the wires, and joints must be properly spliced, soldered and protected with tape. Since all thermocouple wires deteriorate with constant use, renewal, or at least a searching test, is necessary annually, particularly as small errors (less than 10 deg. C.) may cause irreparable damage during solution treatment: since the e.m.f. is extremely small, it is essential to keep all contacts clean, and the insulation sound.

Metals used for Wire

Metals used for thermocouples must not melt or become unduly weak at elevated temperatures, and must resist oxidation and corrosion. The e.m.f. developed should be high, uniform with temperature over the working area, and constant for a long period of time. Platinum and platinum alloys are used for the highest temperatures, but for the treatment of light-alloys, base-metal thermocouples (usually of Chromel-Alumel or Iron-Constantan) suffice. Wires of the base metals may

Temperature Control of Heat-treatment

be any dia. up to ¼ in., but thinner wires (about ⅛ in. dia.) give greater sensitivity. Owing to the greater cost, platinum couple wires are generally about 0.02 in. dia. The wires are insulated from one another by refractory beads, fused silica quill, or some such similar substance, and the couple is generally protected by a sheath. For air furnaces up to 500 deg. C. bare wires are used to give maximum sensitivity, while special couples have been developed for molten salt baths. Platinum wires have, incidentally, the greatest scrap value.

Sheaths

Sheaths may be of a refractory material such as porcelain, fused silica or asbestos, or of metal such as calorized steel, nickel-chromium, pure nickel or stainless-steel. Platinum couples are usually protected by an inner refractory sheath, and an outer one of metal. The thinner the sheath the greater the sensitivity of the wire, although the protection afforded is less.

Sensitivity

The importance of sensitivity may be seen from an example which occurred in a factory where alclad sheet was found to be showing signs of cracking on reheat-treatment. The problem was referred to the suppliers of the sheet, whose technical staff considered that too-high temperature was causing the trouble. In order to reproduce working conditions, the nitrate bath at the factory was stabilized at annealing temperature and then raised to heat-treatment temperature from 380 to 490 deg. C.). The bath pyrometer, which was enclosed in a steel tube, was checked against an instrument with bare thermocouple wires; it was found that the latter registered a temperature rise much more quickly than did the pyrometer normally used. At one point the checking instrument registered 550 deg. C. It was apparent that, using the ordinary bath pyrometer, considerable fluctuation could take place in the temperature of the bath without it being charted on the recorder. The large-dia. metal sheaths of the pyrometer normally used were therefore replaced by thin asbestos sheaths, with a consequent improvement in the sensitivity of the instrument.

INSTRUMENTS

Instruments with a high electrical resistance are used, in order to reduce the effects of possible local increases in the resistance of the circuit due to faulty connections and other errors. Before being despatched from the makers pyrometers are calibrated for the resistance of the circuit, while a final adjustment after installation is made by means of a leads-balance coil. Subsequent alterations result in a loss of accuracy, a fact which must be remembered if instruments are changed.

E.M.F. Measurement

Two types of instrument are used for measuring the e.m.f. set up by the thermocouple: the millivoltmeter and the potentiometer. The former is the more commonly used in industry but the latter is more accurate, since it automatically balances the potential from a standardized cell against the potential from the thermocouple. Whereas the method of the millivoltmeter is that of direct deflection, with the potentiometer no current flows, so that the possibility of errors due to the resistance of thermocouples and leads is eliminated. The necessary periodic checking against a standard cell may be done automatically or manually at regular intervals.

Indicators

Indicating instruments should have a wide scale so that temperatures can easily be read by the operatives, and be so mounted that the scale is at eye-level; a mirror behind the pointer is extremely valuable in reducing reading errors. On some installations temperature is indicated by a colour-light system.

Recorders

In recording instruments a chart is fitted (usually on a drum) below the pointer, and the clockwork or electrically-driven mechanism depresses the pointer at regular intervals on to an inked ribbon or thread interposed between the chart and the pointer. The same mechanism drives the chart, and thus successive positions of the pointer are recorded. Single-point potentiometers often employ an ink-pen, while each type of instrument can record several thermocouples in succession by means of an automatic change-over switch, a multi-coloured ribbon, or a number of threads.

Controllers

A somewhat similar mechanism is used in controllers, the pointer being depressed at given intervals to make or break contacts according to its position in relation to the desired temperature. An auxiliary current, obtained usually from a small transformer, is broken by such contacts and actuates relays (through enclosed mercury switches) to increase or decrease the heat input to the furnace.

Breakages

All systems of automatic temperature-control used in conjunction with thermocouples depend for their efficiency on the soundness of the thermocouples. Breakages are, however, sometimes inevitable in spite of periodic examination. When this occurs, the controlling instrument will tend to zero, and cause the controller to function as it would if the temperature were too low. In other words, the mechanism will cause the heating rate to be increased to its maximum limit. The possibilities of damage to both the plant and the work being treated are sufficiently obvious. To prevent such an occurrance a broken-couple alarm can be incorporated, arranged to give a special warning of breakage and, if necessary, to shut down the heating rate either to a safe level or to zero.

Controlled-recorders

Combination instruments, to indicate, control and record temperature, are frequently used on forced air-circulation furnaces. Controller-recorders are normally mounted near the furnaces in a pillar, which may also enclose most of the switchgear of the plant. Their doors must be readily accessible so that charts and ribbons may be removed without difficulty. Also, since paper charts are subject to dimensional change due to moisture in the atmosphere, an airtight dustproof case is essential.

Correct Siting of Instruments

Although instruments are designed to withstand works conditions, they obviously should not be installed in places where they may be affected by dirt, damp, fumes, shocks or vibrations. Shock-absorbent mountings (for example, of rubber) give protection against shock and vibration, an important factor, since an unsteady pointer makes correct readings impossible and reduces the accuracy of control. Nor should instruments be mounted where wide temperature changes are likely to occur, near heating pipes for instance, or in draughts, or where they are subject to direct radiation of heat. In some installations, the controllers and switchgear for a number of furnaces are located at a suitable central point, with visible signals at the furnaces. When such central points are used for a number of thermocouples individual return wires are preferred to a common return system, because of the greater ease in tracing faults.

Resistance Pyrometers

Resistance pyrometers are based on the principle that the electrical resistance of a platinum wire increases with increase in temperature. A small platinum coil (usually fixed at 1, 10 or 40 ohms, at 0 deg. C.) is held in a protection sheath, and a small electric current passed through it. A high degree of accuracy is obtained. These instruments can be used for both recording and controlling. They are, however, seldom used in light-alloy treatment plant, except for checking other instruments.

Mercury-in-steel, and Pressure, Thermometers

Thermometers of the ordinary type are unsuitable, but the mercury-in-steel and pressure types may be used, although they are not often employed in light-alloy treatment. These latter thermometers consist essentially of two parts. A bulb containing mercury, and connected by a metal capillary tube to a Bourdon-type pressure-gauge, is placed in the furnace. Increase in the bulb temperature increases the pressure throughout the system, the difference being measured by the gauge (which is graduated by a temperature scale). By means of a lever system, the temperature may be recorded on a chart driven by a clockwork mechanism. The range of the mercury-in-steel thermometer is from about −40 to almost 600 deg. C.; but the upper range is increased between 350 and 800 deg. C. by making use of the vapour pressure of mercury. Temperatures are measured with an accuracy of 1 per cent. by each type of pressure instrument, provided that in volume the capillary is less than 1 per cent. of the volume of the bulb, and does not exceed about 100 ft. in length, nor experience temperature changes exceeding 50 deg. C. Owing to the effect of hydrostatic pressure, vapour-pressure-type instruments are calibrated individually, and once installed the relative heights of the bulb and the gauge must not be altered without recalibrating.

INSPECTION OF COUPLES AND INSTRUMENTS

The accuracy of couples and instruments must be checked regularly. Where extreme accuracy is necessary weekly checking is desirable, but more general practice is once each month. Wiring, especially connections, should be examined periodically for faulty insulation, dirt or corrosion. A standard themocouple, with a portable instrument, handled by experienced personnel, is required for the routine checking of production equipment. The hot junctions, protected by the same kind of sheath as that protecting the production pyrometer, must be placed together in the furnace or salt bath. In order to avoid small errors, when tests are made every precaution must be taken to reproduce the normal working conditions. To check a thermocouple completely a series of freezing-point determinations is necessary, the temperatures employed in the light-alloy range being the points of the following pure metals: tin, 232 deg. C.; lead, 327 deg. C.; zinc, 419.5 deg. C.; aluminium, 659 deg. C., and aluminium-copper eutectic, 548 deg. C. Boiling water (100 deg. C.) is also a useful point. Sometimes only one fixed point is checked, but although a couple may read correctly at one point it is not necessarily accurate over the whole range required.

Acknowledgment

The author is indebted to the Aluminium Development Association for the information on which this article is based.

THE ASSOCIATION OF BRONZE AND BRASS FOUNDERS announces that a meeting of members in the Midland area is to be held at the Victoria Hotel, Wolverhampton, commencing 11.45 a.m. Business matters of the Association will be discussed until luncheon at 1 p.m., and on resumption of the meeting at 2.30 p.m., Mr. W. H. Davies will give some practical advice on the installation and operation of the system advocated in the Association's publication "Costing a Casting." All bronze and brass founders in the area are invited to send representatives to the session in the afternoon.

Assistant chief docks engineer of the Humber Ports, Mr. R. M. DYMOND, has died at the age of 52. An engineering graduate of London University, he started his career in the chief mechanical engineer's department at Cardiff Docks. In 1946 he was appointed assistant docks mechanical engineer for the eastern area of the South Wales docks. From 1950 to 1954 Mr. Dymond was assistant mechanical engineer, Humber ports. In 1952 he visited America and Canada as the representative of the Docks and Inland Waterways Executive to study coal and anthracite shipping appliances.

Equipment and Supplies

Bunker Vibrator

Efficient discharge from storage bunkers or hoppers containing powdered, granulated, or lump materials that tend to arch, pack or funnel is claimed to be ensured by the use of an internal bunker vibrator made by Sinex Engineering Company, Limited, North Feltham Trading Estate, Feltham, Middlesex. The device consists of a rotary electric vibrator attached to a steel reed which hangs down into the hopper (see Fig. 1). The complete assembly is suspended from a rolled-steel joist across the top of the hopper by means of anti-vibration mountings, which isolate the hopper structure from vibratory effects. When the equipment is in operation the vibration passes down the reed with increasing amplitude, reaching a maximum at the lower end of the reed, where the material contained in the hopper has a tendency to arch. As vibration loosens and releases the material, the pressure of the latter on the reed varies and causes it to bend and move about in the bunker; vibration is therefore always applied at the most needed point, and thus ensures complete discharge of the contents. Constructed of mild steel, the reed is made up to suit the depth of the hopper for which it is required. Its dimensions vary between 18 and 24 in. wide, $\frac{1}{4}$ to $\frac{1}{2}$ in. thick, and up to 60 ft. in length. This apparatus would seem to be useful for moulding-sand hoppers where serious sticking is encountered.

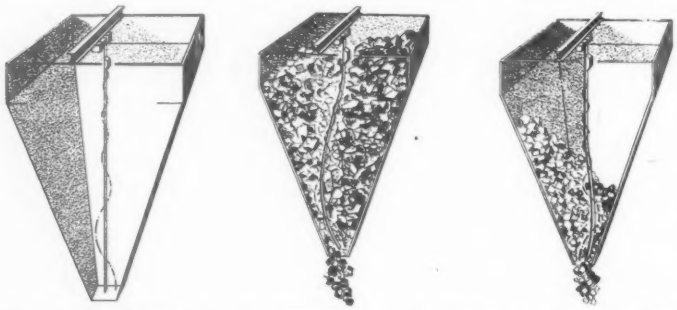


FIG. 1.—*Diagrammatic representation of the operation of the bunker vibrator made by Sinex Engineering Company, Limited, of Feltham, Middlesex.*

Portable Dewpoint Meter

A new dewpoint meter, developed in America and now being manufactured in this country under licence, is applicable in a wide range of processes where moisture contents of dry air and other gases must be determined. It is called the Alnor Dewpointer and is being marketed in this country by the Electric Resistance Furnace Company, Limited, a subsidiary of Efco, Limited, Netherby, Queens Road, Weybridge, Surrey. Typical uses of the meter include checking the dryness of air supplies for refrigeration, for air conditioning, and of atmospheres used in heat-treatment processes. It could possibly be a useful adjunct to cupola control. The meter is portable and self-contained, requires no coolant, and has a measuring range from −80 deg. F. to room temperature (or from 0.0015 to about 2.75 per cent. water vapour by volume). The measurements are made by compressing a sample of the gas to a pressure at which, on suddenly releasing the pressure a mist is formed, the temperature of the dew point then being calculated from the temperature and pressure ratio before expansion. Easy conversion of the sample temperature and pressure ratio to dewpoint temperature is made with an Alnor dew-point calculator.

Electrolytic-conductivity Measuring Bridge

Electronic Switchgear (London), Limited, Works Road, Letchworth, Herts, have introduced a new portable electrolytic-conductivity measuring bridge (Mark 3). The new bridge has a finely divided silvered measuring-dial, which is indexed by a hairline "Perspex" cursor, enabling measurements to be made with great accuracy. A printed ivorine instruction panel is incorporated on the inside of the detachable hardwood cover of the case, and a shoulder strap has been provided for the use of operators who have occasion to carry out routine tests on measuring cells placed at strategic points throughout plant. The small dry battery, which energizes the transistorised circuits, is contained beneath a detachable cover within the accessory compartment—this modification permits the battery to be renewed without the inconvenience of removing the instrument panel. A baize-lined canvas cover is supplied to protect the hardwood carrying-case from damage.

Radiation-monitoring Film

Kodak, Limited, Kingsway, London, W.C.2, announce a new radiation-monitoring film. These films provide an efficient method of assessing the exposure of personel to X-rays and gamma rays. Two emulsion layers of different sensitivities are coated one on each side of the film, and the total density produced on both emulsions together is used as a measure of small quantities of radiation. If, as a result of large quantities of radiation, the density of the film is very high, the more sensitive emulsion can be stripped from the base, leaving the less-sensitive emulsion intact for measurement. Two overlapping ranges of measurement are thus provided. Each film is supplied in a separate light-tight packing, and is ready for immediate use. The films must be stored in a cool dry place, free from contamination by chemicals, fumes or radiation sources.

DEXION, LIMITED, Maygrove Road, Kilburn, London, N.W.6, report that an ingenious and cheap method of space saving was worked out by an ironmonger in Peru, who installed a suspended rack, made of slotted angle, from the ceiling. The idea would seem to have some merit for application in foundries, where floor space is at a premium.

MULTIPLE ACTING FLUX, LIMITED, 336, Watford Way, London, N.W.4, report that they are now handling various forms of artificial graphite, including billets, plates and rods, as well as powder, containing up to 99 per cent. carbon or more, through their works at 10, Collegiate Crescent, Sheffield 10; export orders are negotiated through their associate company Ex-Trans-Im, Limited, of the same address. In the same group is Colloidal Graphite, Limited, which has established at Bernard Lane, Sheffield 2, the production of colloidal graphite in water, mineral-oils and other carriers.

IBF Activities in South Africa

Report for the Session 1958/59

The annual general meeting of the South African branch of the Institute of British Foundrymen was held in Johannesburg in May under the chairmanship of the president, Mr. R. C. Cross. During the business meeting the following officers were elected for the year 1959/60:—*as president,* Mr. K. H. Coombs; *as senior vice-president,* Mr. D. Gordon Jones; *as junior vice-president,* Mr. R. T. Rounce; *as hon. treasurer,* Mr. S. Jane; *as hon. secretary,* Mr. J. Steele; and *as elected members of Council,* Mr. A. A. Guest, Mr. A. B. Anderson, Mr. B. G. Pidermann, and Mr. R. K. Tait. The annual report was then presented from which it was learnt that activities of the branch included extension work in Natal, a meeting in Pretoria, the holding of the first all-day conference, 15 general functions and the annual dinner at which there was a record attendance of 183 members and guests.

During the year, 63 applications for membership had been made—this was also a record number. Including the conference, ten papers had been presented with extremely good attendances on each occasion; four works visits had been arranged and, on two of these, attendance exceeded the 80 mark. Membership changes recorded were 62 additions, five transfers from UK branches, four deletions, two resignations, two transfers to UK branches, and three deaths. The membership total now stood at 371, a net increase of 56 for the year.

Referring next to the Natal section, it was reported that this was now well established under the chairmanship of Mr. J. Robertson, with Mr. J. H. Richmond as hon. secretary. Three papers had been presented since the inaugural meeting in October, 1958, and two works visits had been arranged. There were now 42 members, whereas previous to the first meeting there had been only 8.

Last year, for the 21st anniversary banquet, the branch had for the first time extended invitations to the ladies, this gesture had proved so popular that it had been followed up with two social evenings and attendance on each occasion had reached the 150 mark.

Education Committee

An education committee, formed during the year, besides preparing a memorandum on the subject of apprentice training to the Apprentice Training Board, had also suggested to the vocational guidance section of the Department of Labour, that coloured slides depicting various aspects of foundrywork and patternmaking, would be of assistance to attract apprentices to the industry. The suggestion had been welcomed and the branch had prepared a selection of slides which were shown in the Departments' pavilion at the Rand Eastern Show. The success of the project had led to slides being obtained from various other trades.

More entries were received this year than last for the second Short Paper Competition for the Alexander Medal and Prize, and it was of interest to note that all the entries were from members who had joined the branch during the year. The report concluded by paying tribute to the branch president, Mr. Cross, for the amount of work he had done for the branch during his year of office.

Awards

The following branch awards were then announced: *The A. H. Guy Medal* to Mr. J. J. Marais in recognition of the many papers he had presented to the branch, and for services rendered to the industry to promote the use of synthetic sands for foundry work. *Member's Diploma* to Dr. H. J. van Eck for his paper presented to the 21st Anniversary Conference entitled "Review of the South African Foundry Industry." *Non-member's Diploma* to Mr. H. McC. Lawrence for a paper on "Billets and Bessemers" presented at a branch meeting. *The Alexander Medal* to Mr. S. M. Gray for his entry entitled: "How to Reduce Fettling Costs by Proper Wheel Testing," and the *Alexander Prize* to Mr. G. Skiffington for his paper dealing with "Manufacture and Properties of S.-g Iron." At the conclusion of the meeting, Mr. S. Pienaar proposed a hearty vote of thanks to the president, the hon. treasurer, and the hon. secretary, which was carried with acclamation.

Prize-winning Papers

After the annual general meeting, the two prize-winning papers in the Alexander Medal Short Paper Competition were read by the authors, extracts from which are given below.

How to reduce Fettling Costs by Proper Wheel Testing

By S. M. Gray

Mr. Gray stated that a properly-planned and executed grinding-wheel testing programme is the key to important cost reductions in foundry fettling operations. A good comparative testing programme would take into account all variables and eliminate them by tests. It would lead to true cost comparisons of the wheels tested, and to the best sources for purchasing.

In nearly all grinding operations, but particularly in fettling, he said, there was an ever-changing constellation of varying forces and factors which greatly influenced the outcome of a grinding-wheel test. If these forces and factors were present constantly and to about the same degree, or if they exerted their influence in the same direction, they would not be so exasperatingly troublesome to the testing engineer. But because they were ever-changing, in degree as well as direction, their effects

could not be predicted. Sometimes they might offset and neutralize each other, at other times they might be additive—either in a favourable way so as to enhance the performance of a given wheel—or in an unfavourable way which would detract from its true performance.

Major Variables

The major variables in swing-frame or floor-stand or portable fettling operations were the human element, the machine, and the material being ground. One variable introduced by the operator was the pressure exerted by him on the wheel-work interface; another was the tempo at which he worked. To keep the human element variable to a minimum, it was essential to use the same group of operators to the same degree on each of the samples involved in a test. The variables contributed by the machine were mainly impact stresses on the wheel face. These would be at a minimum in a machine relatively free of vibration, and in this case premature fracture of the exposed abrasive grains, as well as their dislodgement from their seats before they were completely spent, would be avoided. Conversely, a machine plagued with a lot of vibration would cause premature and wasteful fracture of the abrasive grains. Equally significant were the variables resulting from the material ground. The abrasion resistance of alloy steels varied greatly, and this affected the rate of dulling of the abrasive grains exposed in the wheel periphery. Aside from this physical aspect, certain metals have a pronounced effect on the rate of dulling of the abrasive grains due to chemical reaction at high temperatures. Titanium alloys were an example.

Requirements

To minimise the variables the following requirements must be met: (1) The same group of operators must be employed to the same extent on each of the sample lots involved in the test. (2) The same group of machines must be used. (3) The types of material ground in the test, as well as the dimensions of the work, must be the same or very similar. (4) The standard wheel with which the test wheels are to be compared must be included in the same test, and (5) the sample lots must consist of any equal number of wheels.

The author concluded his paper by stating that with the steady increase in labour, maintenance and overhead costs in recent years, the steel industry had found it necessary to increase the output per man-hour in their billet and slab grinding of alloy steels. It had elected to get this increase not by going to softer, faster, cutting wheels, as was done during world war II, but by utilizing higher grinding pressures. It had been clearly established that higher grinding pressures, together with harder grade wheels, gave more economical performance. Care must be taken, however, that this trend toward high grinding pressures did not cause attention to be focused entirely on the rate of cut, to the exclusion of other important factors, such as the sacrifice in wheel life as measured in terms of units of metal removed per unit of wheel consumed; or the removal of a greater than necessary amount of metal to satisfactorily clean a casting or remove defects from a billet.

Manufacture and Properties of S.-g. Iron

By G. Skiffington

Mr. G. Skiffington, in the course of his lecture, gave details of the procedure adopted by his company, the only mass-producer of s.-g. iron in Africa, for the manufacture of this metal. All the moulds, he said, were made either on a jolt/squeeze pin-lift or jolt/squeeze turnover machine, depending on the box size. The patterns were made either of aluminium or brass, mounted on one-inch thick cast-iron plate, and the metal melted in two 42-in. cupolas which were used on alternate days. The cupolas were of the basic-lined type and charged mechanically by means of a skip hoist. A typical charge would be as follows:—150 lb. pig-iron; 350 lb. s.-g. foundry returns; 300 lb. steel scrap; 180 lb. coke; 5 lb. ferro silicon; 40 lb. limestone; 16 lb. fluorspar; and 15 lb. calcium carbide.

When fluorspar was added to the charge it was found to be a strong basic flux and slag liquifier. It melted at a temperature of 1,330 deg. C, in a zone above the normal cupola melting zone. Small amounts of fluorspar seemed to accelerate the fluxing reactions by cleaning the coke and making the slag more fluid before it reached the melting zone.

Mr. Skiffington went on to say that the company operated the sealed ladle process and the equipment consisted of the following:

(1) A strongly constructed chamber in which the process is to take place, constructed of stone or prefabricated with steel plating and a strong door to minimize the danger of accidents occurring.

(2) A pneumatic ram to act as a plunger with sufficient pressure to force the magnesium billet down through the metal in the sealed ladle.

(3) A plunger head which acted as a cover for the sealed ladle when the plunger was in the plunged position. This head also had a ¾-in. dia. drilled and tapped hole, into which the magnesium billet assembly was screwed.

(4) The magnesium billet assembly consisted of a 4-lb magnesium billet encased in a mild-steel canister and a 3-ft. long carbon-dioxide-bonded core. The magnesium billet was screwed on to one end of this core, and the entire assembly screwed into the plunger head ready for treating the metal.

(5) The sealed ladle was constructed of steel plating with a thick refractory lining, which would be fettled after every melt. Two 725-lb. capacity sealed ladles were used in a bank and worked alternately, the metal was superheated in two 650 kva direct-arc furnaces. After pouring into green-sand moulds and being conveyed in cooling baskets on a monorail conveyor, the runners and feeders are knocked off and the castings cleaned in Wheelabrators.

The annealing cycle for s.g. iron castings con-

sisted of heating to a temperature of 900 deg. C. for a predetermined time, then holding at that temperature for a number of hours, and slowly cooling to 720 deg. C. This temperature would be maintained for some time before slowly cooling to 400 deg. C. The furnace was then opened, the bogie withdrawn, and the castings allowed to cool normally.

The feeding requirements of s.g. iron were found to be greater than that of normal grey iron but not so great as that of steel. Ordinary gravity feeders could be used successfully with this metal but they are not found practicable in a mass-production foundry. Side feeders or atmospheric feeders were mainly used and mounted on the joint of the moulding machine plate with a small ingate leading into the casting. A high percentage of slag is produced with this metal and it was therefore important to include more slag traps than is normally found necessary in grey iron. The author concluded by stressing the importance of careful sand preparation for the moulds used in the s.-g. iron foundry.

Mr. K. H. Coombs, the president-elect, proposed a hearty vote of thanks to both authors at the conclusion of a lively discussion of each paper.

Sand as a Heat-exchanger?

It is reported that a novel way of heating air before it is taken into the furnaces is saving fuel in a number of Hungarian foundries. And, says the newspaper *Népszabadság*, if this method were extended to every foundry in the country it could mean an annual saving of 2,000,000 tons of coal. An essential feature of the method is the absorption of flue heat by sand, which is tumbled from the top of the chimney to the air-intake chamber below the furnace. The heated sand then warms up the air going into the furnace. The sand is taken through the chamber back to the top of the chimney in a continuous circuit. The technique, devised by Dr. László Kun of the Thermo-Technique Research Institute, has been successfully tested at the Red Star Tractor factory and the Csepel Metalworks, in Budapest.

Export of Iron and Steel Scrap

At the request of the Ministry of Power, the Board of Trade announce that arrangements have been made permitting the continued export of specified types of iron and steel scrap. An open general licence has been issued permitting during the period September 7, to December 8 (inclusive), the export to any destination of scrap and old metal consisting wholly or mainly by weight of iron or steel and having an f.o.b. value not exceeding £25 per ton in the following forms:—(*a*) compressed baled material and (*b*) scrap turnings and borings.

The effect of this is to permit the free export of specified grades of iron and steel scrap authorized by the current open general licence (which expires on September 6), to continue until December 8.

Publications Received

Properties of Cast Iron at Elevated Temperatures. Issued as ASTM Special Technical Publication No. 248, and published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., USA; price $4.25, or 35s.

The Report covers a project started in 1954 on six commercial low-alloy grey irons and one unalloyed ferritic nodular iron, which were evaluated at 425 and 535 deg. C. by means of metallographic examination, tensile, creep-rupture, thermal-shock and growth tests. The specimens used were in the as-cast and annealed condition. The Report is preceded by a literature survey, and it is interesting to note that some of the classic work on the subject—being out-dated we suppose—is not considered worth referring to as a source of information. The conclusions drawn from the researches are excellent.

A sensible procedure was carried out on the original 12 samples submitted by industry, that is they were screened after some preliminary tests and the number was reduced to seven, which underwent extensive investigation. The research was carried out at the Southern Research Institute (which we believe is located in Alabama), and it is a matter of some academic interest that room temperature is deemed to be 80 deg. F.

From the results obtained it can be stated that, in general, the alloys are promising for long-time load-carrying applications, and for applications involving thermal shock at temperatures up to 425 deg. C., but not at 535 deg. C. The test results indicate, however, that the development of low-alloy cast-irons suitable for use at 535 deg. C. is quite conceivable. Variations in alloying have marked effects upon the properties of cast-iron at elevated temperatures. Molybdenum appears to be the most potent alloying element for improving creep-rupture properties, nickel for improving thermal-shock properties, and chromium for improving structural stability. The results of creep-rupture tests indicate that five representative test-alloys could be expected to sustain the following loads in tension for 10 years at 425 deg. C.:

	tons per sq. in.
Test No. 14 Cr/Mo-alloyed grey iron	13.4
" " 1 Mo-alloyed grey iron ...	11.0
" " 10 Cr/Ni/Mo/V-alloyed grey iron	11.0
" " 8 unalloyed ferritic nodular iron	7.6
" " 13 unalloyed grey iron ...	6.7

(The committee was under the chairmanship of Mr. J. S. Vanick.)

Exhibitions

Scottish Industries Exhibition

Kelvin Hall, Glasgow, will be the scene of the third Scottish Industries Exhibition from September 3 to 19. Over 200 exhibitors, representing 100 industries will display their goods. Those stands which will be of major interest to foundrymen will be briefly reviewed in next week's JOURNAL.

Machine Tool Exhibition

The Sixth European Machine Tool Exhibition will be held this year in Paris, from September 12 to 21. Displays which will be of interest to foundrymen will be briefly described in a future issue of the JOURNAL.

Latest Foundry Statistics

Iron Castings production

According to a statement issued by the Iron and Steel Board, production of iron castings in the second quarter of 1959 was 878,590 tons; in the second quarter of last year it was 887,210 tons. Production by district is shown in Table 1.

Following publication of this statement, the Joint Iron Council furnished a detailed commentary on the figures as below:—

General

The figures for the second quarter of 1959 give a clear indication that the ironfounding industry has progressed in its recovery from the serious recession which developed in the second half of 1958. Much, but by no means all, of this recovery has been based on the high level of activity in the automobile industry. Improved trade by other industries using iron castings, notably steel, engineering, and public works, has played a part.

Total output of iron castings in the second quarter of 1959 at 878,600 tons compares with 828,100 tons in the previous quarter of 1959—an increase of 6 per cent.—and with 887,200 tons in the second quarter of 1958—a reduction of 1 per cent.

Main Sections

For a comparison of the output of iron castings in the second quarter 1959 with output in the previous quarter and in the second quarter 1958 see Table 2.

TABLE 1.—*Production of Iron Castings, by District.*

District.	Iron castings (tons).	
	Second quarter. 1958.	Second quarter. 1959.
Northern	89,050	70,920
North West	96,000	90,290
Yorkshire	98,830	92,970
East Midlands	174,300	184,350
West Midlands	188,550	204,630
Eastern and Southern Counties	93,480	98,650
Scotland and Northern Ireland	88,100	77,660
Wales and Monmouthshire	58,900	59,120
Total	887,210	878,590

The statistics relate to both grey and malleable-iron castings and output is classified according to the main industrial groups purchasing or using the castings.

Generally, owing to seasonal factors such as the incidence of holidays, the second quarter's output in any year is slightly lower than that of the first. This year, however, all sections of the industry, except that providing railway equipment, show an increase in their second quarter's production compared with that of the first quarter of 1959.

The automobile section established a new record with a second quarter production 13 per cent. higher than ever before recorded. The engineering section showed an increase of nearly 5 per cent. compared with the first quarter, but failed to reach the level of a year ago. Pressure pipes and fittings with a rise on the quarter of 10 per cent. virtually reached the production of the second quarter last year.

The production of building and domestic goods castings changed little compared with the previous quarter but maintained a rate of output noticeably ahead of corresponding periods in 1958. Ingot-mould production rose significantly in the quarter but, in line with the output of its customer industry—steel—was slightly below the second quarter of 1958.

Labour

The number employed in the ironfounding industry at the beginning of July 1959 was 123,000—virtually the same as three months previously but 6½ per cent. lower than a year ago.

TABLE 2.—*Output of Iron Castings, by Section.*

Section.	Second quarter, 1959 (thousand tons).	Percentage change in output.	
		Previous quarter.	Second quarter, 1958.
Automobile (including tractors)	175.0	+13.3	+21.4
Engineering (*a*)	287.0	+ 4.9	− 7.2
Building and domestic	135.6	+ 0.2	+11.1
Pressure pipes (*b*) and fittings ..	126.4	+10.4	− 0.5
Ingot moulds (*c*)	90.6	+ 7.9	− 1.8
Railway equipment	64.0	− 3.2	−30.8
Total	878.6	+ 0.1	− 1.0

(*a*) Including machine tool, textile machinery, electrical, shipbuilding, etc.
(*b*) Mainly gas and water.
(*c*) Mainly for the steel industry.

Distington's Continuous Casting

Establishment of a continuous casting division which will specialize in the design and manufacture of continuous casting plants for both ferrous and non-ferrous metals is announced by the Distington Engineering Company, Limited, a subsidiary of the United Steel Companies, Limited, Sheffield.

The division is currently engaged in design work for a wide slab machine which is to be installed at Ste. des Fonderies de Pont-à-Mousson in France, and which will be capable of producing continuously cast slabs up to 50 ins. wide and from 4 to 8 ins. thick. Distington Engineering is participating in this project and will design and build continuous casting plants on behalf of and under licence from Concast A.G., of Zurich, in which United Steel recently became a shareholder.

The personnel of Distington Engineering's continuous casting division has been closely associated with the experimental machines which have been developed and operated by United Steel since 1952.

McKee, Head, Wrightson, Limited

Two companies that have been associated for the past 15 years in contracting for the steel industry throughout the Commonwealth have formed a subsidiary company to serve the petroleum and chemical industries.

Head, Wrightson & Company, Limited, Thornaby-on-Tees (Yorks), and Arthur G. McKee & Company, Cleveland, Ohio, equally share the ownership of McKee Head Wrightson, Limited, a British company with headquarters in London, which will combine the experience of the two parent companies in the designing, engineering, and building of petroleum refineries and chemical plants throughout the world, exclusive of the North American Continent.

It is emphasized by the parent companies that each will continue its own individual activities as previously. Arthur G. McKee & Company and the 98-year-old British company are of similar financial positions, both having shown considerable progress during the last two decades.

Notes from the Branches

Northampton and District Section

Visit to Morris Motors

Members of the Northampton and district section of the Institute of British Foundrymen made their first works visit of the year in June when 33 members visited the works of Morris Motors, Limited (Tractor and Transmissions Branch), Birmingham. Here the section was shown round the tractor machining and assembly shops, where the Nuffield Universal tractor, together with the light three-cylinder version, was being manufactured. The party was also conducted to the Apprentices Training School. It was pointed out that many ex-apprentices of this works now held senior executive positions in the British Motor Corporation.

Visit to Dartmouth Auto Castings

The party then travelled to the New Inns Hotel at Handsworth, where they were received and entertained to luncheon by a number of executives of Dartmouth Auto Castings, Limited. Following luncheon, the party moved out to the firm's No. 1 foundry. Here apprentices took over as guides, and about two hours were spent going around the plant. This was most interesting to all concerned and was considered to be the best foundry so far visited as far as high production was concerned. The foundry was producing close on 1,000 tons per week of flywheels, brake drums, manifolds, gearboxes and similar castings, with a labour force of 420.

Moulding and Knockout

The foundry was split up into five production units, each consisting of moulding machines, mould conveyor and knock-out, the whole of the sand for four of the units being obtained from one central sand-plant, which produced 240 tons of sand per hour from eight mixers running continuously from the start to the finish of the shift. The fifth unit had its own sand plant of 90-tons-per-hour capacity, and incorporated a station master where 140 moulds were made per hour in boxes approximately 36 in. by 30 in. by 10 in. by 10 in. One of the moulding units incorporated two pairs of shockless-jolt automatic machines. The other three units were equipped with manually-operated pin-lift machines, which were also producing 120 moulds per hr. per pair of machines, although in a considerably smaller box approximately 20 in. by 18 in. by 6 in. by 6 in. Knock-outs on these moulding units were all of the self-discharging type, feeding the castings and sprue into pendulum conveyor buckets.

Shotblasting and Fettling

From the knock-out station the pendulum conveyor took the castings round a cooling tower before returning them for shot-blasting. The fettling shop was a very simple but effective layout of roller track, upon which was used a number of small steel bins. The castings were fed out of the shotblast machine into the bins and down a series of lengths of roller track, with inter-connecting switches to pedestal grinders and other operations normally found in such a shop.

General

The general impression given by this foundry was one of extreme efficiency. It was stated that most of the operatives worked on piecework, and that much attention was paid to time and motion study. The percentage of scrap castings was phenomenally low at 1½ per cent., and the visitors were interested to see that a small amount of shell coremaking was going on, apparently on an experimental scale. The CO_2 Process was also being used for a lot of the cores, quite apart from the use of the orthodox oil-sand practice, but it

Group photographs taken at the Annual Dinner of the IBF East Midlands Branch in the Midland Hotel, Derby at the end of last Session.

Left (from left to right): Mrs. Gardom and Mr. J. W. Gardom, retiring branch president; Mrs. Peace and Mr. A. E. Peace, the retiring IBF national president, with Mr. G. C. B. Lamb, the branch secretary. Above: Mr. P. A. Russell; Mr. H. J. V. Williams; Mr. M. M. Hallett, and Mr. B. N. S. Perry.

Notes from the Branches

should be appreciated that the majority of the work was not cored. Three of the four 12-tons-per-hr. hot-blast cupolas were in blast at the time of the visit, and all the metal was collected in receivers prior to pouring in ladles. After walking round the foundry, members of the section were entertained to tea in the works canteen, when a further opportunity was offered for the exchange of information with the same executives they had met at luncheon. Simultaneously, Mr. W. Brindley, the managing director, welcomed the visitors and spent some time himself replying to questions. Mr. R. Jelley, senior vice-president of the section, proposed a vote of thanks and said how much both he and the section had enjoyed the visit.

Personal

Mr. R. A. G. DUFF has been appointed a director of F. H. Lloyd & Company, Limited. Mr. H. P. R. SCOTT has resigned.

Mr. G. R. B. FIELDEN, engineering director, Ruston and Hornsby, Limited, Lincoln, has been appointed managing director of Hawker Siddeley Brush Turbines, Limited.

Mr. A. K. SEN has been appointed managing director and Mr. P. C. KAVANAGH, assistant managing director, of Indian Oxygen & Acetylene Company, Limited, a British Oxygen Company subsidiary.

Mr. MARK RUSSELL, secretary of S. Russell & Sons, Limited, of Leicester, has been appointed a director. Mr. KENNETH HOUGHTON, manager of the constructional department, has been appointed a departmental director.

Mr. J. HILES, head of the science department of Sheffield College of Technology, and acting principal since last February, has been appointed principal of the College in succession to the late Dr. G. LAWTON.

Mr. H. P. MILLAR, who recently joined the Federated Foundries' group, has taken up the assignment at Thomas Allan & Sons, Limited, Bonlea Foundry Thornaby-on-Tees, Yorks, and has also moved his residence to that area.

Mr. and Mrs. ERNEST PENNETT celebrated their diamond wedding anniversary on August 16. Mr. Pennett, who is 88, retired from work as a storekeeper with Hepworth & Grandage, Limited., engineers, Bradford, when he was 83.

Sir GEORGE GARDNER, director of the Royal Aircraft Establishment, Farnborough, since November, 1955, has been appointed Controller of Aircraft at the Ministry of Supply. He succeeds Air Chief Marshal Sir CLAUDE PELLY, who has been appointed Member (Designate) for Weapons of the Atomic Energy Authority.

Air Commodore, N. A. TAIT, O.B.E., M.I.MECH.E., has joined the sales staff of Simmonds Aerocessories, Limited, a member of the Firth Cleveland group, and will be based at the group's headquarters at Stornoway House, St. James's, London, S.W.1. Air Commodore Tait was, until his retirement, Director of Aircraft Engineering at the Air Ministry.

Borax & Chemicals, Limited, announce that Mr. W. J. HATCHLEY, who has been managing director of the company since its inception, will relinquish executive duties on August 31, but remain a member of the board. Mr. G. L. THOMPSON, also connected with the company for many years, will be appointed managing director with effect from September 1.

United Dominions Trust, Limited, announce that Mr. G. CUTTS has been appointed manager of their Sheffield branch in place of Mr. R. A. NEAL, who has been posted overseas to join the board of the Bank of Trinidad (Gordon Grant), Limited, a newly-formed company in Trinidad in which UDT has a controlling interest. Mr. D. H. CATER will replace Mr. Cutts at UDT's Derby office.

Mr. L. W. BUCKLER, has been appointed general manager of the Rolls-Royce, Limited, Derby group of factories and a director of the company's aero division. Mr. Buckler, who has been general manager in charge of manufacturing, worked during the war on the installation of Merlin engines in tanks and on early development of the jet aero engine. He joined Rolls-Royce as an apprentice in 1922.

Ernest Scragg & Sons, Limited, textile-machinery manufacturers, Macclesfield, announce that Mr. F. SCRAGG, former managing director of Sydney and E. Scragg, Limited, who has been in charge of textile developments since his firm became members of the Scragg group in 1957, has been appointed a director, as have also Mr. TIMOTHY DUFORT, commercial manager of the group, and Mr. H. HANCOCK, group sales manager.

Electric Resistance Furnace Company, Limited, announce that Mr. H. J. TUCKER, southern-area sales manager for the past 10 years, has been appointed service manager. Mr. Tucker, who joined the organization in 1935, will continue to operate from the company's head office in Queens Road, Weybridge, Surrey. Two other appointments notified are those of Mr. C. A. MCNEILL, formerly technical sales manager of another furnace manufacturing company, who has joined the technical sales staff at the Midlands-area office in Birmingham, and Mr. M. J. PARSONS who has joined the sales organisation at the head office in Weybridge. Mr. Parsons has worked for many years with Edwards High Vacuum, Limited, and will specialize in vacuum heat-treatment processes and equipment.

Holman Brothers, Limited, Camborne, Cornwall, announce the appointment of Mr. JAMES L. RITCHIE as sales director, with responsibility for the direction of the Holman Group's sales organization at the Camborne headquarters and in the United Kingdom and overseas. He has become an associate director of Holman Brothers and is based at Camborne. Mr. J. F. HOLMAN, who recently became joint managing director of the company, had hitherto been responsible for group sales direction covering the products of the parent company as well as those of the subsidiary companies, Climax Rock Drill and Engineering, Limited, Dustuctor Company, Limited, Maxman Power, Limited, and Goodyear Pumps, Limited. Mr. Ritchie was previously with Consolidated Pneumatic Tool Company, Limited, as assistant to the managing director, and before that a director of the main board of Aveling Barford and of Goodwin Barsby, Limited, and Barford (Agric.), Limited.

Increases of Capital

HAWTHORN BAKER, LIMITED, engineers, etc., of Dunstable (Beds), increased by £88,000, in £1 ordinary shares, beyond the registered capital of £14,500.

R. W. HILL & COMPANY, LIMITED, civil and general engineers, etc., of Chelmsford (Essex), increased by £22,500, in £1 ordinary shares, beyond the registered capital of £2,500.

ATLAS COPCO (GREAT BRITAIN), LIMITED, engineers, diesel engine manufacturers, etc., of Wembley (Middx), increased by £100,000, in £1 shares, beyond the registered capital of £100,000.

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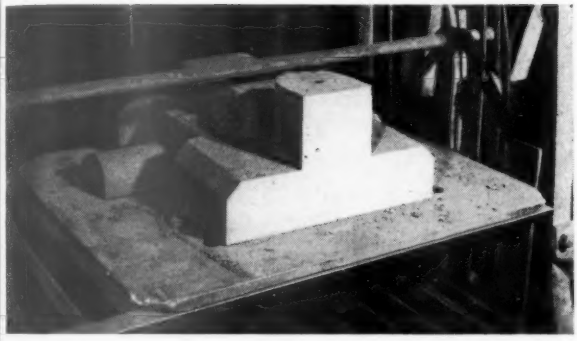

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News in Brief

THE ENGINEERS' GUILD is removing from 78 Buckingham Gate, London, S.W.1, to 201 High Holborn, London, W.C.1, at the end of September.

ENGLISH STEEL CORPORATION, LIMITED, Sheffield, have ordered an 80-ton electric furnace for casting in vacuum. The equipment will be able to deal with ingots of up to 150 tons in weight.

OWING TO the recent dispute in the printing industry, the industrial safety division of the Royal Society for the Prevention of Accidents has had to postpone the national safety campaign until the week beginning November 23.

DAVY-BRITISH OXYGEN, LIMITED, a joint subsidiary of Davy-United, Limited, Sheffield, and British Oxygen, Limited, which was formed to provide new oxy-steelmaking processes, has moved its headquarters to Sheffield from Harlow New Town.

LORD DUDLEY GORDON, chairman of Hadfields, Limited, Sheffield, presented clocks to 49 employees on August 13 to mark the completion of 25 years' service. Also they were enrolled as members of the firm's "25 Association," which now has a membership of 1,430.

SHEFFIELD CORPORATION TRANSPORT DEPARTMENT, has followed up a repeat order for 14 of Leyland Motors' new Leopard single-deck buses, with another order for 18 rear-engined Atlantean double-deck buses. Earlier orders from Sheffield were for six Leopards, now in operation, and for 25 Atlanteans.

ALTHOUGH the Birmingham brass firm of Alfred Case & Company has been taken over by the Delta Metal group it will continue to be directed by four members of the West family. The brass strip output of the company now runs at about 4,000 tons annually but it is planned to double that output within the next few years.

A COMPLETELY AUTOMATIC 1,500-gall-per-hr. dairy bottling line for the Waikato Milk Company, Limited, Hamilton, New Zealand, has been assembled for trial running at the works of Dawson Bros., Limited, bottlers' engineers, Gomersal, near Leeds, who secured the contract, worth over £26,000, in face of keen home and overseas competition.

SIMMONDS AEROCESSORIES, LIMITED, Treforest, Glamorgan, members of the Firth Cleveland group, have entered into licensing agreement with Pryor Manufacturing Company of Mansfield, Ohio, USA, to manufacture hydrant fuel-dispensers and general civil and military aircraft refuelling vehicles for world-wide territories, except the American continents.

TWO NEW SUBSIDIARIES have been formed by the Birmingham Small Arms Company, Limited, to take over the small tool and broach manufacturing activities of B.S.A. Tools, Limited. They are B.S.A. Small Tools, Limited, and the B.S.A. Broach Company, Limited. Management of all three companies will be carried on by the same executive and personnel as hitherto.

TO MEET AN INCREASED DEMAND for electricity meters in Scotland, Ferranti, Limited, Hollinwood (Lancs), has commenced production at its Dundee factory. This new arrangement will speed delivery of meters and provide increased service facilities. In 1957 the company started to manufacture distribution transformers in Inverness in order to satisfy the requirements of the Scottish market.

A NEW WORKS has just been completed at a cost of over £20,000 by Thomas Hill (Rotherham), Limited, mechanical and electrical traction engineers, of Rotherham (Yorks). The company manufactures the diesel hydraulic locomotives of Sentinel (Shrewsbury), Limited, a Rolls-Royce, Limited, subsidiary, as well as carrying out repair and conversion work to many types of industrial locomotives.

LAST YEAR when the National Society of Master Patternmakers visited Germany, they were interested in a small bench router made by Friedrich Zimmermann of Esslingen. Mr. J. J. Harvey bought one of these machines. He is so satisfied with it that as from January 1, next year, his firm, J. J. Harvey & Pressurecast, Limited, Lime Bank Street, Manchester, 12, is taking over the United Kingdom selling rights.

FIRE WRECKED SEVERAL MACHINE-SHOPS at the Bo'ness Iron Company's works early on August 21. As firemen fought the flames, officials tried to probe the facts, for a small fire was discovered in the pattern-shop at teatime on the previous night—but was put out within half an hour. The patternshop roof collapsed in the second outbreak, and electric motors, wooden patterns, and other equipment were wrecked.

A ONE-WEEK COURSE for sixth-form grammar-school boys, the first to be held at the Thornbury Works, Bradford, of English Electric Company, Limited, ended last Friday. During the week, the ten boys who had taken the course, toured the various departments at the works and attended talks on careers, promotion prospects, and the type of work available in engineering. The boys all agreed that it had been well worth while.

TO FACILITATE CO-OPERATION between the company and the aircraft industry, the British Oxygen Company, Limited, is forming a new organization, British Oxygen aviation services. A number of the company's subsidiaries will be involved in the new venture. The company announces that a new works at St. Helens (Lancs) will start supplying oxygen and other industrial gases to the Lancashire area in about December of this year.

THE ONLY TWO BIDS for two of a number of contracts to supply generators and turbines for the Tennessee Valley Authority's Wheeler Dam project have been submitted by the English Electric Company, Limited. One of the bids, the authority states, was of $3,415,334 (about £1,219,300) and the other $5,025,315 (about £1,794,000). English Electric was underbid by an American company on two other contracts, and by an Austrian company on two more. The TVA board has 60 days in which to consider the bids.

IT IS REPORTED that unemployment figures in West Bromwich are falling, and there is a general feeling of optimism in the foundry trade. Last week, Mr. J. K. Ferguson manager of the West Bromwich Exchange said that the improvement shown in the employment figures during the past six months is being maintained, and an official of one of the foundry associations has also said: "The trend of trade in the foundry industry has been one of improvement in the recent months. This has resulted in a higher figure of employment."

Mr. W. A. GIBSON MARTIN of the British Iron and Steel Federation gave a talk on "Steel in the National Economy" to Walsall Rotarians at their meeting last week. He surprised his audience with statistics relating to production and price range. Saying that one large British plant had produced 10,000,000 tons of steel, he added that the cheapest kind of steel was the ship's plate which was worth about £43 a ton. High-grade tool-steel ranged up to as much as £40,000 a ton. The

(*continued on p.* 92)

Recent Wills

ILLAR, J. A., a director of Dorman, Long & Company, Limited, Middlesbrough £29,441

ROSE, W. H. G., a special director of Vickers-Armstrongs (Shipbuilders), Limited £8,975

OOD, D. H., founder of the Constructional Engineering Company, Limited, Birmingham ... £50,558

EIR, VISCOUNT, honorary president of G. & J. Weir, Limited, engineers and ironfounders, etc., of Glasgow £3,304,393

LAT, THOMAS, chairman and founder of Thomas Platt & Sons (Widnes), Limited, engineers, ironfounders, etc. £17,152

RENWOOD, J. R., chairman and managing director of Craven Bros. (Manchester), Limited, machine-tool makers, etc. £117,186

ICHOLSON, SIR JOHN GIBB, an original director and later deputy chairman of Imperial Chemical Industries, Limited £46,588

LARK, O. H., founder and managing director of Clark Bros. (Wolverhampton), Limited, metal spinners and non-ferrous founders £18,628

OPKINS, C. Y., formerly chairman of James Cartland & Son, Limited, brassfounders, of Birmingham, and managing director of Mechanical Products, Limited £89,880

UTTERWORTH, NORRIS, late director and secretary of Crofts (Engineers), Limited, Bradford, and a director of J. Parkinson & Son (Shipley), Limited, machine-tool makers, etc., and Carter Gears, Limited, Bradford £10,100

ILLINGBECK, WILLIAM, chairman and managing director of Barrow Ironworks, Limited, a director of the Barrow Hæmatite Steel Company, Limited, Barrow Quarries, Limited, and Ulcoats Mining Company, Limited £45,858

AYOR, DR. J. B., former chairman and managing director of Mavor & Coulson, Limited, mining machinery manufacturers, etc., of Glasgow, and former chairman of the North British Locomotive Company, Limited £41,432

ILTON, SIR JOHN, late chairman of W. T. Henley's Telegraph Works Company, Limited, former director of the Cable Makers' Association, Regional Fuel and Power Controller for London and South-East England, 1939-45 ... ... £40,172

OBLE, C. S., joint managing director of Noble & Lund, Limited, machine-tool makers, of Felling-on-Tyne, Gateshead, former chairman of the Newcastle section of the Institution of Production Engineers and a member of the North East Coast Institution of Engineers and Shipbuilders ... £90,506

ILLAR, SIR JACKSON, founder and sole partner of Jackson Millar & Company, combustion engineers and engineers' agents, of Glasgow, chairman of Albion Motors, Limited, and a former chairman of the Fairfield Engineering & Shipbuilding Company, Limited, and a director of other companies £23,279

ARKE, SIR WILLIAM J., eminent metallurgist, director of the British Iron and Steel Federation, 1922-46, vice-president of the Iron and Steel Institute and Bessemer Medallist (1947), former president of the British Standards Institution, Institute of Welding the Institute of Fuel, and the Junior Institution of Engineers £24,922

GGO, F. R., deputy chairman of Thos. W. Ward, Limited, Sheffield, and chairman and managing director of the Ketton Portland Cement Company, Limited, Thomas Smith & Sons (Rodley), Limited, John Smith (Keighley), Limited, Widnes Foundry & Engineering Company, Limited, and the Shap Granite Company, Limited £60,438

AY, H. J., shipyard manager for John I. Thornycroft & Company, Limited, London, S.W.1 ... £5,710

IMSON, K. S., late chairman of Gimson & Company (Leicester), Limited, engineers and ironfounders, etc. £112,841

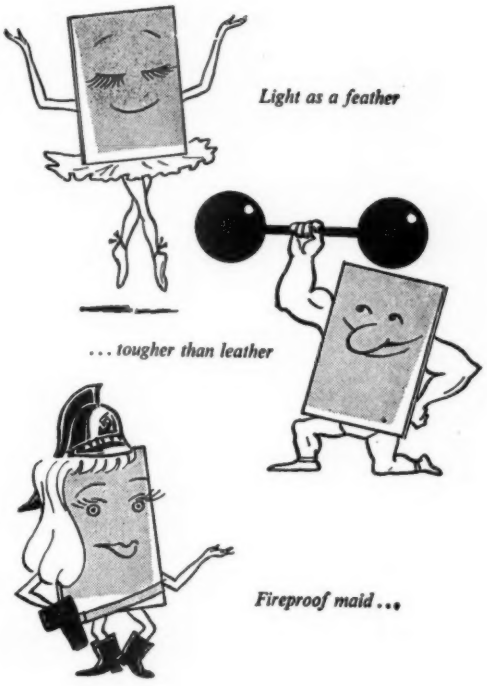
RTON, FRANK, works director of Bulpitt & Sons, Limited, manufacturers of cooking and heating appliances, etc., of Birmingham £68,291

IRD, CAPT. R. H., son of the late William Laird, senior partner of Laird Bros., which became Cammell Laird & Company, Limited £51,629

THERLAND, M. G., for 40 years civil engineer with Sir William Arrol & Company, Limited, bridge builders, crane makers, etc., of Glasgow £11,722

SMITH, A. S., late director of Samuel Osborn & Company, Limited, steelmakers, of Sheffield, and the Star Aluminium Company, Limited, Wolverhampton £211,021

ACLELLAN, W. S., formerly chairman and managing director of P. & W. MacLellan, Limited, engineers, iron and steel merchants, etc., of Glasgow £56,132



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O HOOKERLITE is my delight,
The Core Tray of the century!
And if you ask me why, good sir,
Here is my inventory:—

Light as a feather, tougher than leather,
Phenomenal trays, these core trays,
Fire-proof made, the finest grade,
Of never seen before trays.

Economical, astronomical,
Tres bon trays, these core trays.
Smooth to lie on, hard as iron,
Last for ever more trays.

And now to the men in the foundry stores,
As the rooks would say, for the good of the cores,
Beware of trays that are nearly right,
Insist on trays of HOOKERLITE.

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News in Brief

most expensive of all was that used in the manufacture of watch springs, this being £500,000 a ton.

MARCO CONVEYOR & ENGINEERING COMPANY, LIMITED, of London, in conjunction with the Constructional Engineering Company, Limited, of Birmingham, have obtained an order from Jugoslavia for the supply of a complete mechanized foundry for the production of tractor engines. The order has been obtained in the face of competition both from home and abroad. The whole of the equipment will be designed in Great Britain, but some portions of the steelwork will be fabricated in Yugoslavia. The value of the equipment to be manufactured in this country is £73,000.

F. H. LLOYD & COMPANY, LIMITED, Wednesbury (with their associate companies at Burton and Derby) are staging their annual horticultural show, sports and gala day on Saturday, September 5. In the show, competition entries are open to employees, wives, sons and daughters (or, in some cases, works departments) in well over 100 classes of produce and handicrafts (there is even a competition for cage birds). The stated objective is: "health and friendship in horticulture for each employee and family"—one which the long schedule of events reveals is taken up very enthusiastically by the whole staff.

THE DEPARTMENT OF COMMERCE AND MANAGEMENT of Sheffield College of Technology has organized a special course, starting in November, for young managers and potential managers. Students must be already engaged in industry and sponsored individually by their employers, and full-time attendance at the College for about 15 weeks in each of two years is required. The first year deals with the essential qualities of management required by young executives, and the second with a study of the means of exercising effective control in all fields of business activity, and industrial relations and personnel management.

THE 1,400 EMPLOYEES at the Holwell Works of the Stanton Iron Works Company, Limited, have been notified that some of them may shortly become redundant. In all 150 men might be affected. In a statement to the Press the company regretted the move which it attributes to the continued low demand for high-phosphorus foundry pig-iron which makes it necessary to blow out the No. 4 blast furnace at Holwell Works. This will mean that only one furnace is in operation making other grades of foundry pig-iron. The statement goes on, "The decision will give rise to some redundancy which will be the subject of negotiation between the company and the trade unions concerned. The men involved will be given as long a notice as possible, terminating on October 2." No notices have yet been issued.

BIRMINGHAM AND DISTRICT COMMITTEE of the Confederation of Shipbuilding and Engineering Unions is organizing in September, a ballot among the 75,000 engineering workers in the motor-car industry in Birmingham, who will vote on a proposal that the 1961 holiday should be taken in the first two weeks of July instead of the traditional last week of July and first week of August. It will be recalled that the Coventry and district committee of the Confederation has already held a ballot on a similar proposal and some 80,000 workers in the motor-car industry voted for a change to new holiday dates at the beginning of July. It is thought that owing to the interrelation of Birmingham and Coventry industry connected with the motor industry, there is a strong case in favour of firms in both centres closing simultaneously for the annual shut down.

A MEETING of the German Hardness Testing Group is to be held in Dortmund this year from September 23 to 25. An invitation has been extended to members of the Hardness Testing Group of the Institute of Sheet Metal Engineering to attend this meeting and to submit one or more technical contributions. The chairman of the ISME Group, Mr. J. F. Kayser, hopes it may be possible to accept this invitation and will be happy to hear from any member, or anyone else interested in attending the meeting or offering a paper. The general theme of the meeting is "Measurement of Hardness in Theory and Practice." Anyone interested in further details of this meeting is invited to communicate with the hon. secretary of the ISME Hardness Testing Group, Mr. A. C. Tingle, Gillette Razors and Blades, Great West Road, Isleworth, Middlesex.

Obituary

The death is announced of Mr. FRANK HESKETH, who until his retirement in 1942 was managing director of Isaac Butterworth, Limited, of Rochdale. He was 87 years of age.

Mr. H. J. ROWE, for many years a director of Constructional Engineering Company, Limited, Birmingham, died on Tuesday, aged 69. Brother-in-law of the late Mr. D. Howard Wood, he was also a director of very long standing of Adaptable Moulding Machine Company, Limited, and of E. Tallis & Sons, Limited. Until recently, he was active in the Institute of British Foundrymen and was a past-president of the Birmingham branch.

Mr. STUART NETHERWOOD BARKER, chairman of Bardic, Limited, Northam, manufacturers of aluminium die-castings, died on August 9. Originally Mr. Barker worked with his father, Mr. Joe Barker, at the Ferry Engine Company, Woolston. He was then offered a job with the British Power Boats where he became technical assistant, and was subsequently works manager and then managing director. He left the firm in 1944 and later formed Bardic, Limited.

IPE Medal Awards, 1957/58

The Council of the Institution of Production Engineers announced the following medal awards for the year, 1957/58:

Members' Medal and also the *Hutchinson Memorial Award* to Mr. A. J. Lawrance, works director, Kimber-Allen, Limited, for his paper, "Application of Spark Erosion Machining". *Non-Members' Medal* to Dr. J. E. Littlechild, officer in charge of technical work on chemical plants for the UK Atomic Energy Authority, Springfields Works, Salwick, Preston, for his paper, "Production Problems associated with Industrial Atomic Energy." *The J. D. Scaife Medal Award* to Professor N. A. Dudley, head of the Department of Engineering Production, University of Birmingham, and Mr. W. J. Kease (non-member), computer manager, AEI-Hotpoint, Limited, for their respective papers, "Output Pattern in Repetitive Tasks, with Special Reference to Compensating Relaxation Allowances," and "Computer-assisted Production Control."

The Awards will be presented at the annual dinner of the Institution which is to be held at the Dorchester Hotel, London, W.1, on November 19.

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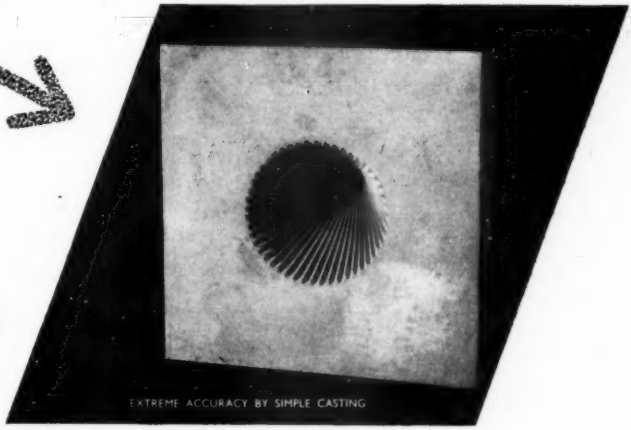

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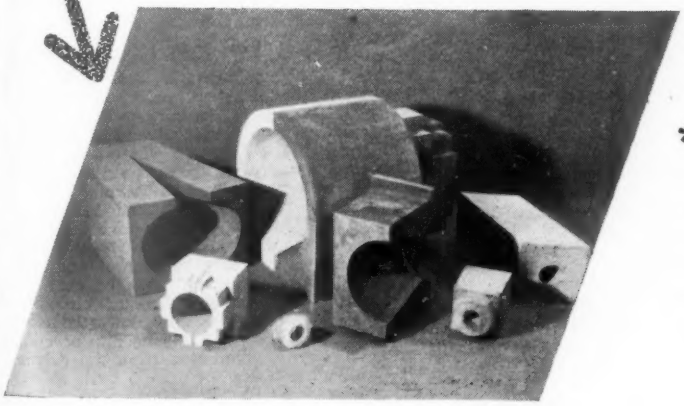

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Raw Material Markets

Iron and Steel

With the return to work of the major portion of the foundry industry on completion of the annual holiday, production of castings will be stepped up considerably and deliveries will be resumed in accordance with consumers' requirements. The biggest demand, comparatively, continues to emanate from the motor vehicle trade for high-duty castings, and the engineering and speciality foundries catering for them have good order-books, which will enable them to continue at least at recent levels of production for some time ahead. High-quality castings for many other trades also comprise, in the aggregate, an appreciable tonnage, which enables the foundries producing them to obtain reasonably good outputs, although overall productive capacity in many instances is capable of undertaking more work, notably for the machine-tool industry, collieries, railways, and the heavy engineering trades. There is plenty of pig-iron available for the use of these foundries, as after present demands are satisfied producers of low-phosphorus irons, hematite, and refined irons have tonnages to spare from current production and many of them have fairly appreciable stocks on hand which they are anxious to reduce.

So far as the light-casting trade is concerned, the improved trading position for many foundries producing these castings is maintained, and this has in turn brought additional demands for high-phosphorus iron, but not in the same ratio, due to the larger usage of scrap. Makers of high-phosphorus iron continue to work below capacity, but these reduced tonnages are more than sufficient to satisfy current requirements and outputs and stocks remain much in excess of present usage. The export market is relieving producers of some tonnage of all grades of pig-iron, but more could be supplied if orders could be obtained against the strong competition from makers abroad.

Business at the re-rollers continues to improve, good demands being forthcoming for small bars and light sections. The present call for these has enabled many of the re-rollers to increase the number of working shifts, and for reinforcing and wire rods there is a strong demand.

Home steelworks are keeping the re-rollers fairly well supplied with steel semis, outputs of which have been reduced recently on account of holiday influences. Present demands are sufficient to cover the steelworks' outputs in many instances for three or four weeks ahead.

Some orders for bars, sections, etc., are being booked by the re-rollers for the export market, but these consist mainly of special quality steels, as for ordinary mild steels overseas prices continue below UK figures, although the prices of continental steel are rising.

Non-ferrous Metals

The labour strike which began at Kennecott Copper Corporation's four western US plants on August 10 spread last week to most other major US copper producers, thereby ensuring that at least 75 per cent. of the nation's capacity will be idle. The actual strike, so long expected, went off like a damp squib in the London market. Realization that US fabricators were loaded with about two to four months' supplies and that foreign metal would be freely available was food enough for pause. Indeed, buyers more than paused, preferring to stay out of the market until the present situation is a little clearer. Consequently, the London price did nothing spectacular.

One of the strongest influences was the rumour that the US steel strike was nearly over and that a truce between labour and management would soon be made. But it was no more than a rumour and the labour situation in the US steel industry is still obviously a long way from being resolved. The markets for copper on both sides of the Atlantic are dull and all concerned are awaiting developments. Meanwhile, there have been no changes in the US price structure, with both custom smelters and producers quoting 30 cents a pound.

News calculated to shock comes from Rhodesia, where it is reported that the European Mineworkers' Union—4,500 strong—has proposed the nationalization of the Copperbelt mines. This is reportedly contained in a lengthy memorandum and it is understood that approaches may be made to the 26-man commission of inquiry which is examining the Rhodesian Federation before its constitution is revised next year. The idea behind the proposal to nationalize is that the unions believe that if the mines were nationalized it would go a long way towards solving the problem of African advancement because the Government could more easily lay down job classification acceptable to both black and white.

Tin continues to experience remarkably steady trading conditions. Demand is good in the East, where the price has edged up to near its peak point for the year. This activity was helped by the completion of the Malayan elections and the statement by the Prime Minister, Tunku Abdul Rahman, that foreign capital would be encouraged and that mineral resources are scheduled for further development. Demand in New York tends to be patchy, but it is better than it has been of late as more and more observers of the industrial scene are convinced that the US steel strike will soon come to an end. In London steady trading conditions prevail and with useful buying from the Continent it is felt that the price would be several points higher if it were not for the buffer stock manager disposing of his surplus stock.

Lead continues quiet on both sides of the Atlantic. The market in London is satisfactory and the quotation has been steadily advancing. In the US the production capacity of both lead and zinc is affected by the copper strike. But this will only assume important proportions if the copper strike spreads to include American Smelting & Refining Company. The position is not clear—a situation reflected by quiet trading conditions. The US price is unchanged at 12 cents a pound.

Zinc continues to be a good market and rumours that the US steel strike would soon be over gave it a bright glossy look. The price in such circumstances held firm, and demand has been satisfactory in both London and New York, taking into account that not much inquiry is coming in from the galvanizing trade. Canada has raised the price ¼ cent.

As a postscript to lead and zinc it was announced from Washington at the beginning of this week that the US Senate had formally ordered the tariff commission to make new fact-finding studies of lead and zinc, giving particular attention to the US importation of lead and zinc products. The tariff commission is asked to submit "specific findings" as to current condition in the lead and zinc industries and as to what additional import restrictions, if any, may be required, "so that mining operations in the US may be conducted on a sound and stable basis."

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August 26, 1959

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P, 6-ton lots or over, £23 5s. 0d., delivered Birmingham, £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.: North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent., 6-ton lots or over: N.-E. of England (local iron), £24 14s. 0d.; Scotland (Scotch iron), Zone S.1, £25 0s. 6d.; Sheffield, £26 2s. 6d.; Birmingham, £26 11s. 6d.; Wales (Welsh iron), £24 14s. 0d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire, in 6-ton lots or over.

FERRO-ALLOYS

(*Per ton unless otherwise stated, delivered*)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £41 0s. 0d. to £43 10s. 0d., scale 15s. 0d. per unit; 75 per cent. Si, £56 10s. 0d. to £60 10s. 0d., scale 15s. 0d. to 16s. 0d. per unit.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 10d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 8s. 7d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 11s. 7d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £77 0s. 0d. to £81 0s. 0d., basis 60 per cent., Cr, scale 26s. 0d. to 27s. 6d. per unit; over 6 per cent. C, £74 10s. 0d. to £77 10s. 0d., basis 60 per cent. Cr, scale 26s. 0d. to 27s. 6d. per unit; 2 per cent. C,* 1s. 7½d. to 1s. 10½d. per lb. Cr.; 1 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 0.15 per cent. C,* 1s. 9d. to 2s. 0d. per lb. Cr; 0.10 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.06 per cent. C,* 1s. 9¾d. to 2s. 0¾d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £245 0s. 0d.; 96/98 per cent., £275 0s. 0d.

Ferro-columbium.—65/72 per cent., Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (standard).—78 per cent., £66 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., 100 tons & over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 6 to 35 tons, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), under 10 tons, £34 17s. 0d.; silico-manganese, under 10 tons. £43 16s. 6d.; free-cutting, under 10 tons, £36 14s. 6d. SIEMENS MARTIN ACID (under 10 tons): Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (under 10 tons).—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

* Average 68–70 per cent.

FINISHED STEEL

Heavy Plates and Sections (under 10 tons).—Ship plates, (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £66 10s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £68 10s. 0d.; nickel-chrome, £99 4s. 0d.; nickel-chrome-molybdenum, £111 17s. 0d., in lots of 5 tons to under 10 tons.

NON-FERROUS METALS

Copper.—Cash, £228 0s. 0d. to £228 5s. 0d.; three months, £227 0s. 0d. to £227 10s. 0d.; settlement, £228 5s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 3½d. per lb.; rods, 249s. 6d. per cwt. basis; 20 s.w.g., 284s. 6d. per cwt.

Tin.—Cash, £792 0s. 0d. to £793 0s. 0d.; three months, £792 0s. 0d. to £792 10s. 0d.; settlement, £793 0s. 0d.

Lead (Refined Pig).—Second half August, £71 15s. 0d. to £71 17s. 6d.; second half November, £73 5s. 0d. to £73 7s. 6d.

Zinc.—Second half August, £84 17s. 6d. to £85 0s. 0d.; second half November, £83 12s. 6d. to £83 15s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £120 10s. 0d.; rolled zinc (boiler plates), all English destinations, £118 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £99 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 10⅝d. per lb.; sheets to 10 w.g., 202s. 0d. per cwt.; wire, 2s. 8¼d.; rolled metal, 202s. 0d. per cwt.

Brass (Brazing).—BS1400, B3, £152; B6, £195.

Brass (High Tensile).—BS1400, HTB1, £180; HTB2, £200; HTB3, £212.

Gunmetal.—BS1400, LG2, £188; LG3, £199; G1, 1% £249; G1, 1%, £236.

Phosphor Bronze.—BS1400, PB1 (AID released), £283; BS1400: 90/10/1, £266.

Leaded Phosphor Bronze.—BS1400, LPB1, £210.

Phosphor Bronze Strip, etc.—Strip, 290s. 9d. per cwt.; wire, 4s. 1½d. per lb.; rods, 3s. 4d.; tubes, 3s. 4d.; chill cast bars: solids 3s. 3¾d.; cored 3s. 4¾d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 10½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 3¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 2¼d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £71 10s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £180 0s. 0d.; aluminium bronze (BS1400), AB1, £227; AB2, £236.

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ISI Translations

From amongst the most recently published lists of translations available from the Iron & Steel Institute (4, Grosvenor Gardens, London, S.W.1), the following have been selected as being of interest to founders. The price quoted is that for single copies, postage extra, there being reductions for quantities ordered. Readers writing for translations, or for further information, should mention this JOURNAL when doing so.

1243 POLASEK, J., and E. ZELINKA: Planning of Transport in Iron and Steel Works. *Hutnicke Listy* (Prague), 1958, July, pp. 626-631. (£5 15s. 0d.) The importance of transportation in iron and steel works for the calculation of the running costs. Transport of material into the works. The connection between the public railway system and the works and transport organization. Technical and economic factors; methods for solving the transportation problems of steel works. (Author's summary.)

1282 GAGIN, S. D.: Efficiency of Electric Steel Production by the Duplex Method of Oxygen Converter and Electric Furnace. *Kislorod* (Moscow), 1957, (6) pp. 1-11. (£4.) Conversion to duplex working is described and many results are tabulated. It is concluded that a cost reduction of 3 to 7 per cent. with a reduced capital investment of 12.2 to 15.8 per cent. could be expected. The supply of scrap was improved, furnace productivity could be doubled and the duplexing method gave more flexible working and better synchronization than O.H.-electric-furnace working. Top blowing with oxygen gave adequate dephosphorization. (ISI abstract.)

BISI 608 SAVEIKO, V. N.: Mechanism of Hot-tearing of Steel Castings. (£3.) pp. 241-251.

BISI 609 GRUZIN, V. G.: Pouring Temperature and Hot-tearing. (£2 10s.) pp. 252-260.

BISI 610 TRUBITSYN, N. A.: A New Method for the Determination of Linear Contraction, Stress, and the Resistance of Alloys to Hot-tearing. (£1 15s.) pp. 261-266.

Translations in course of preparation include:

1330 YUSHKEVICH, P. M., and S. A. FEDEROVA: Microstructure of Cast High-speed Steel. *Metallovedenie i Obr. Met.*, 1955, (3), pp. 21-25. (Included in response to requests received—List B 32.)

1365 KOPINECK, H.-J., *et al.*: Ultrasonic Testing of Products of the Iron and Steel Industry. *Stahl u. Eisen*, 1959, May 28, pp. 786-797.

1370 TROMMER, W.: Interaction between Steel and Moulding Materials. *Giesserei*, 1955, Aug. 18, pp. 433-440. (Abstract *JISI*, 1956, Sept., p. 90.)

1298 BANDOW, K. & K. WAGNER: A Contribution on Deoxidation and Desulphurization in the Cupola Furnace. *Giesserei*, 1958, vol. 45, (15), July, 17, pp. 409-417. (£5 5s.)

SUMMARY: Description of a number of tests and measurements demonstrates how the iron can be successfully deoxidized in the cupola furnace and the sulphur content favourably influenced at the same time. The deoxidizing effect was proved by the determination of the ferrous-oxide content in the slag. It is insufficient to take only one of the measurements mentioned in the hope of obtaining a favourable effect. Deoxidation and desulphurization are such complicated processes, depending on so many factors, that every measure must be considered and applied in order to obtain successful results. For instance, it is not satisfactory to believe that one can adequately reduce the sulphur content simply by increasing the manganese content without taking due account of the slag basicity, or to try to reduce the sulphur content solely by increasing the basicity, without previously lowering the ferrous oxide content in the slag. The problem must therefore be viewed in its entirety.

Provided that the cupola furnace is properly run and furnace conditions in general are satisfactory one may summarize the findings as follows:—

1. Deoxidation imples reduction of the ferrous-oxide content. It is advantageous to perform the reduction in the cupola furnace itself. In this way no loss of temperature occurs in the iron and the length of time available permits the separation of the deoxidation product from the iron.
2. Deoxidation leads to a lowering of the gas content in the iron, which is equivalent to a decrease in rejected material and an improvement in the quality of the iron.
3. Deoxidation leads to a lowering of the losses of burnt iron, silicon, and manganese, this being equivalent to a reduction of costs.
4. The lower content of ferrous oxide achieved by deoxidation increases the capacity of the slag to absorb sulphur, i.e., there is an improvement in the desulphurization conditions, in other words, the quality of the iron is improved.
5. Deoxidized iron is more easily worked, which is equivalent to lower costs.
6. The increase in the slag basicity promotes both desulphurization and the reduction of the ferrous oxide content.

For the foundryman the following conclusions may be drawn for application in practice. To obtain optimum conditions with respect to the quality of the iron, to decrease losses of burnt material and also to achieve a certain uniformity the iron should be deoxidized in the cupola furnace. For this purpose a number of briquetted ferro-alloys are available with, however, a varying degree of efficiency. The best effects are obtained with calcium-silicon, ferro-manganese and silicon-carbide. Here it should be noted that the efficiency of the briquetted ferro-alloys is modified when used in the hot-blast furnace, deoxidation being dependent on the temperature.

With regard to desulphurization, optimum values can likewise be achieved if the iron is well deoxidized in the furnace. In this connection it is essential that the factors which promote desulphurization, i.e., a higher-manganese content, a sufficiently high basicity of the slag, high furnace temperatures, etc., are adjusted to favourable values. Questions still requiring clarification must be investigated in further tests.

The initials HB, etc., stand for the organization to which enquiries for the following translations should be made, quoting the reference numbers—addresses are quoted at the end of this item

C.T.S. 335 ANAN'IN A. A. and B. P. CHERNOBROVKIN. A Cupola with Continuous-slit Tuyeres and Controlled Blast. *Liteinoe Proiz.* 1956, (1) pp. 10-13. (Abridged Trans. appeared in FOUNDRY TRADE JOURNAL, 1958, vol. 104, Jan. 30, p. 109.)

IRSID T 1246 BIRYULIN, V. T. and V. O. SADOVSKII. Influence (in of Nickel on the Resilience of Austenitic Manganese-prep) Steel. *Trudy Inst. Fiz. Metall.* 1956, No. 18, pp. 66-71.

B. COKE R.A. No. 42 3609 JUNGBLUTH H.: Coke Evaluation by the Cupola Furnace Test. *Giesserei*, 1955, vol. 42, No. 1, pp. 2-6. Trans. by F. Liebesny, B.Sc., A.L.A. Issued 1955, Oct.

B. COKE R.A. No. 58 3923 JUNGBLUTH, H.: Efficiency of a Cupola Furnace. *Giesserei*, 1956, 12 Apr. vol. 43, pp. 180-4. Trans. by F. Liebesny, B.Sc., A.L.A. Issued 1957. Jan.

HB 4452 KACHALKIN, G. S.: Study of Boron-alloyed High Chromium/Nickel (Hypereutectoid) Cast Iron. *Metallov Obra Met.* 1958. Dec. pp. 58-61. ($2.90.)

M. 321 LISITSIN, S. N.: New Method of Joining Cast-iron Pipes. *Vodosn. i. Sanit. Tekh.* 1959, 1, pp. 38-39.

SMT Mar. 15, 1959 LOPATKO, I. F. and USOSKIN, G. I.: Method of Measuring Thicknesses with the use of an Ultrasonic Pulse Thickness Gauge. *Zavods Lab.* 1958, (12) ($5.00).

HB 4518 MIL'MAN, B. S. *et al.*: Desulphurization of Liquid Cupola Iron by Magnesium. *Liteinoe Proiz.* 1958, vol. 9, No. 11, pp. 15-17. ($4.25.)

B. COKE R.A. No. 43 3616 NAVARRO ALCACER, J. and J. A. DE ANDRES. A Study of Combustion in the Cupola Furnace. *Giesserei*, 1955, vol. 42, No. 6, pp. 124-127. Trans. by F. Liebesny, B.Sc., A.L.A. Issued 1955 Oct.

HB 4563 NOVIKOV, I. I. and others: Grain of Solidifying Metal Refined by Vibration. *Liteinoe Proiz.* 1959, No. 2, p. 42. ($2.50.)

B. COKE R.A. No. 56 WESEMANN, F., U. GRAF and R. WARTMANN: New Way of Assessing the Strength of Coke by Sieve Analysis and Trommel Test. *Stahl u. Eisen*, 1956, vol. 76, pp. 133-144. Trans. by Z. K. A. Moszynski. Issued 1956, Nov.

Symbols for sources of translations:—

B. COKE R.A.: British Coke Research Association, Chesterfield, Derbyshire; C.T.S. and M.: DSIR Lending Library Unit, 22, Chester Terrace, London, N.W.1; H.B.: Henry Brutcher, P.O. Box 157, Altadena, California; IRSID: I.R.S.I.D., 185, Rue President Roosevelt, St. Germain-en-Laye (S-et-O), France; SMT: Soviet Metal Technology, 11, Bleecher Street, N.Y.12, N.Y., U.S.A.

Changes of address

The address of the London office of the WOLVERHAMPTON METAL COMPANY, LIMITED, is now 64, George Street, London, W.1. GEORGE SMART (FOUNDRY SUPPLIES), LIMITED, have removed to 227, West Regent Street, Glasgow, C.2. SMITHS AVIATION DIVISION has been transferred from Cricklewood to Kelvin House, Wembley Park Drive, Wembley, Middlesex. After more than 25 years at Ingate Place, London, S.W.8, STREAM-LINE FILTERS, LIMITED, are moving to new premises at Henley Park, Normandy, near Guildford, Surrey, the headquarters of the parent company, Vokes, Limited. The move is expected to be completed this month.